

daily papers that there is in Michigan but one poisonous snake (rattle snake), that the largest snakes we have are the blue racer, fox snake and pilot snake, which seldom attain a length of over six feet, that the breath of the "blowing adder" is riot poisonous, that snakes do not sting with their tongues nor swallow their young, it would call forth numerous protests and snake stories by "eye-witnesses" exactly to the contrary.

It seems absurd to one acquainted with these interesting animals to have to deny such stories. Our reptiles are only dangerous as they are poisonous, and the poison is only conveyed by large fangs and only possessed by one species—the rattle snake. On the other hand there are few groups that will better repay a study of the habits, both for the reason that a knowledge of the natural history of the forms is of value in the study of their distribution and relationships and because so little is known on the subject. The work on the natural history and distribution of the forms must be preceded by a determination of the species, but fortunately the latter is not difficult for our forms are few and in general well defined. The classification is based on structural characters, of course, but the external characters are sufficient for the identification of Michigan forms and have alone been used in this report. The anatomy is dealt with in most of the standard text-books on zoology.

In the identification of species the following characters (compare figures) should be noted:

Snakes.

1. Form of body and general size.
2. Arrangement of scales on the top, sides and under surface of head (Figs. 21, 22).
3. Arrangement of scales on dorsal surface of body and the number of rows at various places, i. e., between the head and anus (Fig. 23).
4. Whether the dorsal scales are smooth or keeled.
5. Number of large plates on the ventral surface between the head and tail (Fig. 23).
6. Character of anal plate, i. e., whether single or divided (Fig. 23).
7. Character of scales on the ventral surface of the tail, i. e., whether in a single or double series.
8. Coloration.

Turtles.

1. General size.
2. Shape of upper (carapace) and lower (plastron) shell.
3. Surface of shell, i. e., whether covered with horny plates or by a soft skin.
4. Size of plastron as compared with opening of carapace, also form of the bridge between the plastron and carapace (Figs. 25-27), and whether or not the plastron is divided by a transverse hinge.

5. Number and arrangement of plates in the different series on carapace and plastron (Figs. 24, 25).
6. Character of anterior end of upper jaw, i. e., whether notched or projected into beak.
7. Character of biting and grinding surfaces of jaws, particularly as regards width of grinding surfaces.
8. Extent of web on digits.
9. Coloration.

The above outlines may very easily be elaborated by teachers into laboratory directions. We would suggest, first, the identification of specimens accompanied by notes on individual and sexual variation; second, observations on the habits of captive specimens; third, field study of habits and habitats; fourth, the preparation of tables to show in a comparative way the characters and habits of the different species studied; and, fifth, a summary of the ways in which the characters are evidently adaptive.

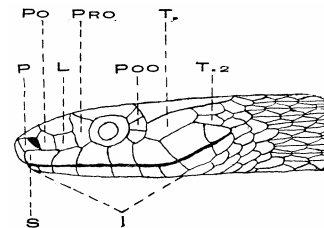


Figure 21. Head of snake, side view, to show arrangement of scales.

P, prenasal; Po, postnasal; L, loreal; Pro, preocular; Poo, postoculars; T, first temporal; T₂, second temporals; S, superior labials; I, Inferior labials.

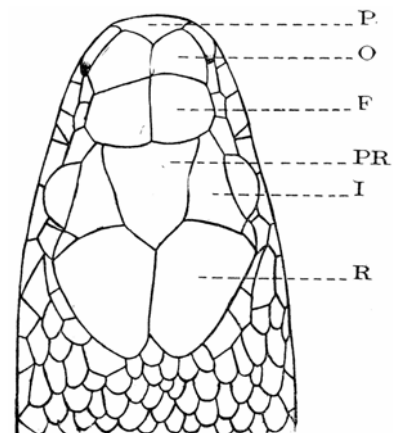


Figure 22. Head of snake, side view, to show arrangement of scales.

P, rostral; O, internasals; F, prefrontals; PR, frontal; I, supraocular; R, parietals.

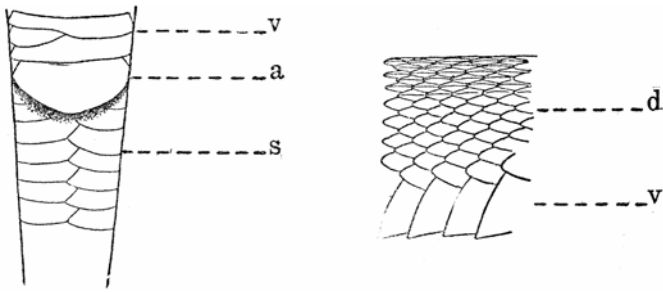


Figure 23. Scales on the body of a snake. (After Cope.)
v, ventrals; a, anal plate; s, subcaudals, d, dorsals.

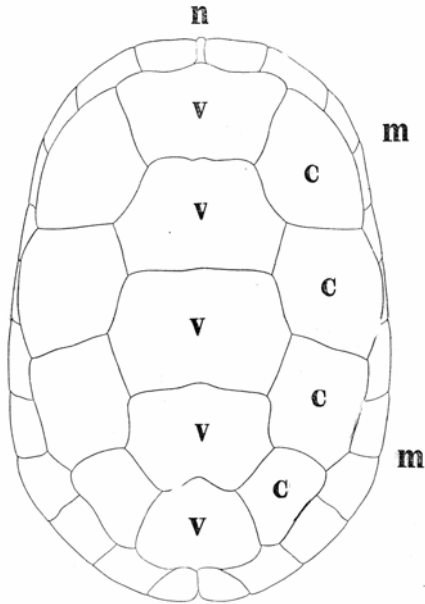


Figure 24. Carapace of *Emydoidea blandingii*, to show position of plates.
v, vertebrals; C, costals; N, nuchal; M, marginals.

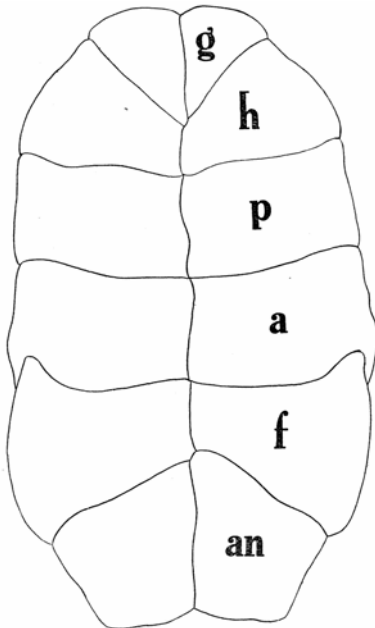


Figure 25. Plastron of *Emydoidea blandingii*, to show position of plates.
g, gulars; h, humerals; p, pectorals; a, abdominals; f, femorals; an, annals.

METHODS OF COLLECTING AND PRESERVING SPECIMENS.

Collecting: As the rattlesnake is the only poisonous serpent in Michigan, the collecting of reptiles may be done with safety by any one well enough acquainted with this species to distinguish it. With the exception of the rattlesnake, all of the Michigan snakes may be grasped in the hands, with no more dangerous results than would occur in the case of a bird the size of a robin. It is always most convenient to grasp the animal by the neck, however, as it is then more easily handled and examined. Cloth bags about the size of those used to hold corn meal or a little smaller should be carried in the field. The snakes, turtles and lizards may be dropped into these and carried back alive to the laboratory or work room.

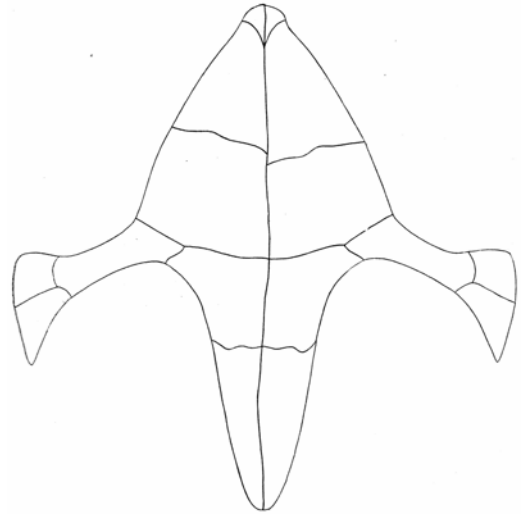


Figure 26. Plastron of *Chelydra serpentina*.

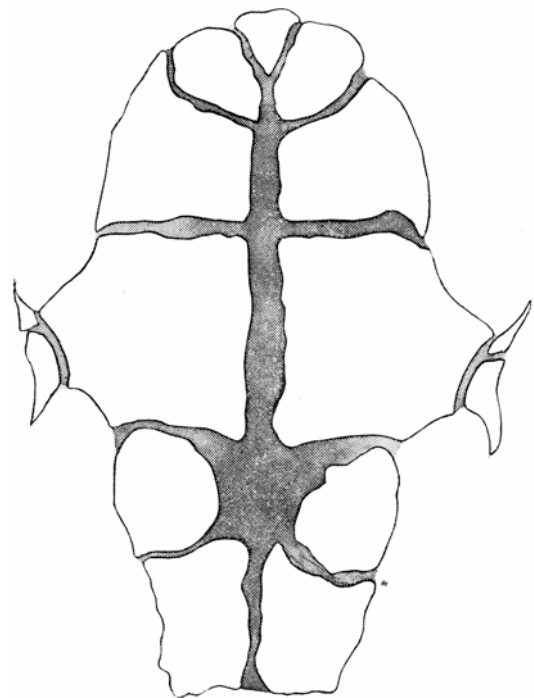


Figure 27. Plastron of *Kinosternon odoratum*.

Lizards may frequently be grasped in the hand and always with impunity, but if seized by the tail there is great probability that this alone will be secured, as the animals part with this member readily. The most efficient way to capture them alive is to cautiously slip over their heads a noose made of horse hair, thread or fine wire and placed on the end of a stick. Turtles may be readily picked up by the carapace (upper shell), it only being necessary to avoid the jaws of the larger ones.

Collectors who wish to obtain series of specimens in a short time will find it more advantageous to shoot the larger snakes, lizards, rattlesnakes, and those forms that frequent the margins of lakes, ponds and streams. In our collecting we find it very convenient to carry a small, double-barreled shot-gun (44 gauge, which takes a 40-85 brass rifle shell, or a 28 gauge) or a 22 caliber target pistol bored smooth and shooting the .22 shot shell. We load the shotgun shells with a small charge of black powder, and dust shot (No. 14). Charges of these sizes do not usually greatly injure the specimen.

Cages. Very efficient and cheap cages for snakes and lizards may be made by placing a sliding pane of glass in the top of a shallow, light wooden box. The pane of glass serves as a window through which the animals may be observed, and also as a door through which they may be taken in or out or food introduced. It is always best to have the glass on top so that it can be opened temporarily without danger of the inmates escaping, and holes should be bored thru the side of the box and covered with screen, so as to provide air. Water in a small dish fastened to the bottom of the cage should always be present.

Turtles (except the box turtle) should be placed in a metal tank in shallow water with stones upon which they may climb. No covering is necessary if the sides are reasonably high or the edges turned inward. The box turtle should have a dry cage.

Specimens should be fed shortly after being placed in the cage, and rather regularly thereafter, for if they can be induced to eat there will be no trouble in keeping them alive. Water should be kept in the cages at all times.

Preservation of Specimens: The animals captured alive should be killed by immersing, while still in the bags, in a pail of water. When dead they should be removed from the bags and either injected freely (snakes and lizards along the belly, turtles behind the fore legs and in front of the hind legs) with 4% formalin, by means of a hypodermic syringe, or if a syringe is not available, slit open. Several, slits about an inch or two inches long (according to the size of the specimen) should be made along the ventral surface of the snakes (none on the tail). One short slit will serve for the lizards, and the turtles may be slit open in front of the hind legs and behind the fore legs. The formalin solution may be made by adding 24 parts of water to 1 part of the 40% solution of formalin sold as pure, and the results are

much better if the better grades of formalin (i. e., Shering's) are used. The specimens should then be placed in pans (do not crowd) and covered with the same solution. When well hardened they may be transferred to glass jars or covered crocks and covered with 75% alcohol. In the case of large specimens of turtles the shell only need be saved.

A label should be attached to each specimen, giving the locality, date of collection, collector and habitat, but if a notebook or catalog is kept, the specimen may be given a serial number and the data kept in the notebook or catalog opposite the corresponding number. The label should be tied about the body in the case of lizards and snakes (about one-third of the way back from the head in snakes and just behind the forelegs in lizards) and on the left hind leg in turtles. Only in the case of the latter should the string be tied so tightly as to crease the skin.

DESCRIPTIONS OF MICHIGAN REPTILES.

CLASS REPTILIA.

The living reptiles are cold-blooded vertebrates that breathe by means of lungs and usually have a covering of horny epidermal scales; the latter sometimes supported by bony dermal plates. The only Michigan species that does not have the body covered with scales is the soft-shelled turtle (*Platypeltis spinifera*). In external form the body is elongate and limbless (snakes), somewhat elongate and usually quadrupedal but occasionally apodal (lizards and crocodilians), cuirassed and quadrupedal (turtles). The quadrupedal lizards are frequently confused with salamanders, but the quadrupedal salamanders (which alone occur in Michigan) always lack the bony or horny covering characteristic of reptiles, the skin being thin and moist. The apodal lizards are frequently confused with snakes, but the only apodal lizard in northeastern North America, the so-called glass snake (*Ophiosaurus ventralis*), may always be distinguished from snakes by the presence of eyelids and external ears. This lizard has never been recorded from Michigan, although it is said to occur in Wisconsin. Numerous morphological characters other than those given characterize the Class Reptilia and may be found by referring to any vertebrate zoology.

Distribution of the Class Reptilia in Michigan.—The distribution of each species is discussed in detail with its description. In general the reptile fauna of the state is characterized by the small number of forms. This is due in large part to the northern latitude of the region, as the reptiles are primarily a tropical group. The influence of temperature upon the distribution is also shown within the state. It is true in both orders that as one goes northward from the southern boundary of the state the number of species gradually decreases. Thus it may be seen by an examination of the maps that twenty-five or all but one of the species in our fauna have been recorded from the two southernmost tiers of counties while only six have thus far been found in the northern

peninsula, and only one occurs there and not in the southern peninsula. It must be admitted, of course, that our information on the intrastate distribution of the species is far from complete, but enough has been learned to make it quite evident that further work will not overthrow this conclusion.

Another general fact of distribution may be pointed out, namely, that there is a western element in the fauna of the northern peninsula. This is at present only shown by the occurrence of *Chrysemys bellii* in that region, but it is in harmony with what has been shown to occur in other groups.

KEYS TO THE ORDERS AND SUBORDERS OF MICHIGAN REPTILES.*

- a¹. Body elongate and covered with small scales. Anus a cross-slit. Order Squamata (Lizards and Snakes).
 - b¹. Limbs present. Eyelids movable. An external ear opening. Suborder Sauria (Lizards), 28.
 - b². Limbs absent. No external ear opening or movable eyelids. Suborder Serpentes (Snakes), 29.
- a². Body short and broad and enclosed between two (upper and lower) shields. Limbs present. Anus rounded or a longitudinal slit. Order Testudinata (Turtles), 48.

ORDER SQUAMATA—SUBORDER SAURIA (LIZARDS).

Description: As indicated by the key, the lizards of Michigan may always be known from the other reptiles by the combination of characters, presence of small scales over the body and of four limbs. As already said, they are frequently confused with the salamanders but may always be told from them by the fact that the skin is never smooth and moist.

Key to the Genera and Species of Michigan Lizards.

- a¹. Body covered above with fine tubercular scales. Tongue deeply bifid. *Cnemidophorus sexlineatus* (L.)†
- a². Body covered above with rather large, imbricated scales. Tongue slightly notched. *Eumeces quinquilineatus* (L.).

EUMECES QUINQUILINEATUS (Linnaeus).

BLUE-TAILED SKINK.

(Pl. VIII.)

Plestiodon vittigerum, ‡ Hallowell, 1856, 310.

Eumeces fasciatus, Smith, 1879, 6. Clark, 1905, 110.

Eumeces quinquilineatus, Cope, 1900, 637-638.
Ruthven, 1911a, 263-264.

†The genus *Cnemidophorus* has not been recorded from this state, so it will not be considered further in this work. *C. sexlineatus* occurs in northern Indiana, however, and is to be looked for in southwestern Michigan in the sand dunes along Lake Michigan.

‡The synonymy given under each species includes only papers that refer to Michigan specimens.

Description: Four well developed limbs. Body covered with rather large, imbricated, smooth scales. Tongue flat, moderately long, free, slightly notched in front, and covered with overlapping scale-like papillae. Head with symmetrically arranged plates.

The color of the blue-tailed skink varies greatly with age. The color of medium sized individuals is, above dark olive with five bluish or greenish white, or yellowish stripes (one median and two lateral on either side); under surface pale; tail usually bright blue. Old specimens are reddish olive with the stripes obscure (females) or wanting (males) and the head coppery red. Young specimens are jet-black with bright yellow stripes.

Habits and Habitat: This skink is distinctly diurnal, being most active on warm, bright days in summer. Little is known of its habitat preferences in Michigan, but in other regions it is usually found in wooded areas, being seen frequently in piles of brush or fallen logs. It is very agile, and, like most of the smaller lizards, its tail breaks easily so that if seized by this appendage the animal easily escapes by parting with the captured portion. The following account of the habits of specimens observed in the sand region of Huron County has been given by the writer (Ruthven, 1911a, 263-264).

"In the woods of the sand region it was found on the dry ridges, under and in decaying logs, where it fed on the insects that frequent such situations. It was, however, much more common than elsewhere under the drift logs on the fossil beaches, and also on the middle beach on the present shore, at the extremity of Sand Point. The logs strewn along the fossil beaches were in an advanced stage of decay, and usually consisted of an outer shell of better preserved wood covering a mass of decomposed debris, the decomposition taking place most rapidly next to the ground. This apparently furnished a very favorable habitat for these lizards, great numbers of which were found in the decomposed material when the outer shell of the log had been removed. (Pl. VIII.)

"The eggs were laid in the same material, the female generally scooping out a small hollow in the bottom of which the eggs were partially buried in the debris. Both in the woods and on the beaches nests were occasionally found in the sand beneath a log or board where there was only a small amount of decaying wood, but in every case there was at least a small amount. Females taken on June 19 were pregnant, containing large eggs apparently nearly ready to be laid. The first sets observed were on July 2, and on and after this date nests of eggs were found in numbers. Everything went to show that the eggs are mostly laid about the first of July. None were observed before this date, and those collected on July 2 were all clean—they usually become

*It is hardly necessary to say that the keys in this paper are highly artificial. They are designed only to furnish an easy and efficient means of identifying the species.

much stained from the decaying wood after being in the nest for some time. The number of eggs in the set was counted in eight instances and were as follows: 6, 6, 8, 8, 9, 11, 13, 14. An examination of the pregnant females shows that the number in each set varies with the size (age?) of the female, the smaller ones having 6 to 8 eggs, the larger ones 9 to 14. It is interesting to compare this with the statement of Ditmars (1907, 202) that he found the normal numbers to be 3 or 4, and that of Strecker (1908, 169) the several sets that I have examined were all of 8 eggs each.'

"It was interesting to observe the behavior of the female when with her eggs. As is well known she remains with them until they are hatched, but for what purpose is not evident. We usually found them coiled about the eggs, but sometimes they simply lay beside them. In any case there seemed to be no attempt to come in immediate contact with the eggs, and indeed this would have been impossible in most instances, as the eggs themselves were not even in-contact with each other, being somewhat scattered about in the decaying debris. However, there seemed to be a disposition on the part of the female to keep her set together; several times I saw a female leave her position and crawl about the eggs, and when she encountered one which I had displaced, lick it and then nose it back with the others. If care was taken in removing the outer shell of the log to expose the nest, the female would remain with the eggs, only burying herself deeper in the loose debris when her head was exposed to the light.

"The first young of the year were observed on July 31, when a female was found under a small log on a sand beach, coiled about a nest of 8 eggs from which the young were emerging."

Ditmars (1907, 202) states that the "food consists largely of insects, but well-grown specimens will feed upon the eggs of birds, or newly born wood mice, often discovered by the lizard as it investigates the crevices of fallen trees." Surface (1908a, 251) records the larva of a Geometrid moth in the stomach of one specimen. Cope (1900, 638) states that a captive specimen gorged itself with wood lice (*Oniscus*).

Range: The blue-tailed skink was probably not uncommon in the southern part of lower Michigan before the timber was removed. Whether or not it was of general distribution will probably never be known; it is now apparently very rare over much of this region. It has been reported from Genesee County (Hallowell, 1856, 310; Cope, 1900, 637), Ann Arbor (Smith, 1879, 6), Barry, Kalamazoo, Kent, Montcalm, Ottawa, St. Joseph and Van Buren Counties (Clark, 1905, 110). It was observed to be quite common in the sand region along the south shore of Saginaw Bay, between Bayport and Port Crescent in 1908 (Ruthven, 1911a, 263-264), and specimens have recently been received from St. Clair and Oakland Counties. Three specimens (one accompanied by eggs), collected by W. J. Beal in Lenawee County (no date), are in the University of Michigan collection, and we have examined a specimen

taken at Alma, Gratiot County. These are the only specimens from Michigan that the writer has seen. There is a record in the University of Michigan Museum catalog of a specimen (No. 369) collected by E. W. McGraw at Ann Arbor, but the specimen cannot now be found.

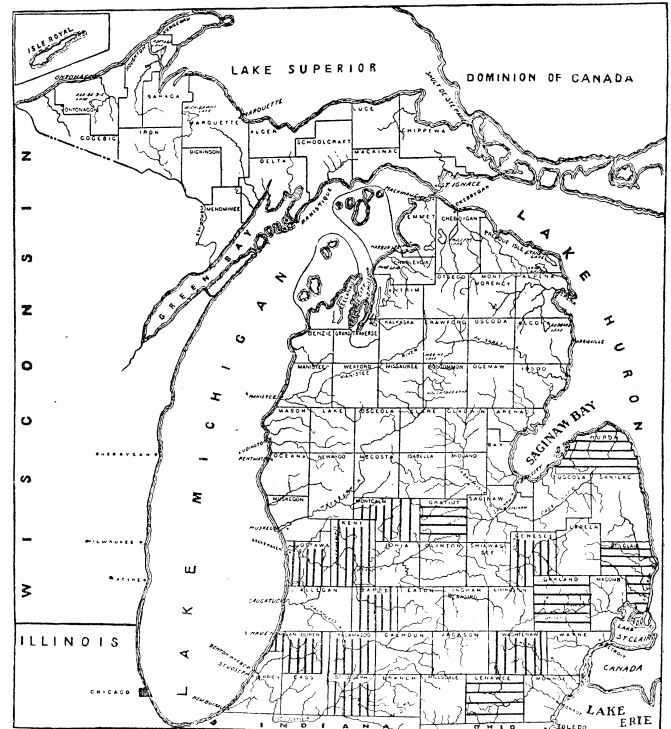


Figure 28. Distribution of *Eumeces quinquilineatus*. Horizontal ruling, specimens examined; vertical ruling, reports only.

ORDER SQUAMATA—SUBORDER SERPENTES (THE SNAKES).

Description: As previously stated the Michigan snakes may be distinguished from the other members of the class in the state by the absence of limbs, external ear openings, and movable eyelids. The body is elongate and covered with scales. The scalation is as follows: small imbricated smooth or keeled scales forming longitudinal and diagonally transverse rows on the dorsal surface of the body and tail. A single series of large transverse and imbricated scutes on the ventral surface of the body with a somewhat larger single or divided plate (anal) just in front of the anus. A single or double row of imbricated scutes on the ventral surface of the tail. Large symmetrically arranged plates on the head.

Key to the Snakes of Michigan.

- a¹. No pit between the eye and nostril. Tail not terminating in a rattle.
 - b¹. Anal plate divided.
 - c¹. Dorsal scales keeled (occasionally but faintly).
 - d¹. Loreal plate absent, *Storeria*.
 - e¹. Oculars 1-2.....*S. dekayi*, p. 83.
 - e¹. Oculars 2-2.....*S. occipitomaculata*, p. 85.
 - d². Loreal plate present.
 - e¹. Rostral plate greatly developed and protruding.....*Heterodon platyrhinus*, p. 87.
 - e². Rostral plate normal, i. e., flattened over the end of the muzzle.
 - f¹. First 3-5 rows of dorsal scales smooth, the rest weakly keeled, *Elaphe*.
 - g¹. Color above black or with obscure blotches*E. obsoletus*, p. 90.
 - g². Color above yellowish to light brown with prominent dark brown blotches.....*E. vulpinus*, p. 93.
 - f². Scales of all of the dorsal rows (except often the first) strongly keeled.
 - g¹. Dorsal scale rows never less than 21-23-21-19-17.*Natrix sipedon*, p. 95.
 - g². Dorsal scale rows never more than 19-17.
 - h¹. A light lateral stripe on the 1st and 2nd rows, no dorsal blotches.*Regina leberis*, p. 98.
 - h². No light lateral stripes, dorsal blotches present*Clonophis kirtlandi*, p. 100.
 - e². Dorsal scales not keeled.
 - d¹. A single nasal plate pierced by the nostril.*Liopeltis vernalis*, p. 102.
 - d². Two nasal plates, the nostril between them.
 - e¹. A yellow collar. Uniformly blackish above,*Diadophis punctatus*, p. 104.
 - e². No yellow collar, adults uniformly green to blackish above, young spotted.....*Bascanion constrictor*, p. 107.
 - b². Anal plate entire.
 - c¹. Dorsal scales smooth. Dorsal blotches present. No stripes....*Lampropeltis doliaetus triangulus*, p. 110.
 - c². Dorsal scales keeled, a dorsal and two lateral (one on either side), light stripes.....*Thamnophis*.
 - d¹. Tail generally more than .27 of the total length,*Thamnophis sauritus*, p. 113.
 - d². Tail generally less than .27 of the total length.
 - e¹. Lateral stripe on the 2nd and 3rd rows. Labials generally 7/10.....*Thamnophis sirtalis*, p. 119.
 - e². Lateral stripe on the 2nd, 3rd, 4th rows anteriorly. Labials generally 6/8.....*Thamnophis butleri*, p. 116.
 - a². A pit between the eyes and nostril. Tail (in all but very young individuals) terminating in a rattle.....*Sistrurus catenatus*, p. 124.

STORERIA DEKAYI (Holbrook).

DEKAY SNAKE.

Tropidonotus dekayi, Holbrook, 1842, IV, 54.

Storeria dekayi, Smith, 1879, 7. Notestein, 1905, 114. Clark, 1902, 194; 1905, 109. Baird and Girard, 1853, 135-136. Miles, 1861, 233. Cope, 1900, 1002-1003. Ruthven, 1911a, 266-267.

Description: A small snake seldom attaining a length of more than a foot. Body tapering toward the neck and tail. Head small but distinct. Cephalic plates normal; rostral normal. Sides of head rather high. Loreal

absent, being fused with the posterior nasal: nostril situated laterally.

Dorsal scale rows, except very rarely, 17 throughout the entire length of the body. Supralabials 7; infralabials 7, very rarely 8 or 9. Oculars generally 1-2; rarely the postoculars are 3 in number, and occasionally fused into one scale, preoculars very rarely 2. Ventrals 120-137, subcaudals 44-57, anal plate divided.

The ground color above varying from dark chestnut or dark slate to pale brownish yellow, the lighter shades most common. On the vertebral line (occupying the median three and the halves of the adjacent rows) a pale yellow or greenish band, which is generally more distinct in the specimens in which the ground color is light. This band margined on either side by a darker shade of the ground color (in individuals light enough to show it), and by a row of more or less prominent black spots that may be distinct and encroach on the pale band even to the extent of fusing across it or may be so small as to be only indicated or entirely absent. The dorsal row is one of three of alternating spots that may be present on either side, all of these usually being absent or only indicated on the scales, except more often on the anterior part of the body. On the neck the spots are fused into a transverse spot on either side, these being irregular in shape and varying in size. Top of head usually dark brownish yellow, densely speckled with black. A heavy blotch of black pigment below the eye, arid frequently a black bar crossing the posterior part of the first temporal and the upper and lower labials. Other head markings variable. Belly pale, with a row of very small spots on either side (one on each end of a scute) that are frequently absent and often irregular (several small ones on each scute). Newly born individuals are said to be dark gray or black above, with a ring of grayish-white around the neck. "Their dark hue changes rapidly and during the warm months succeeding their first hibernation they acquire the brown of the adult form" (Ditmars, 1907, 267).

Habits and Habitat: *S. dekayi* is rather interesting in that owing to its small size, sober colors and retiring habits it is not exterminated by civilization, but is able to live within the limits of towns, where it is frequently found on the sidewalks, in vacant lots, etc. It seems to prefer dry woods, and probably remains in concealment most of the time as does its ally the red-bellied snake.

Surface (1906, 139) records the following items of food in the stomachs of four Pennsylvania specimens: "Earthworms in one; slugs in three; undetermined snails in two; and undetermined insect larvae in two." Atkinson (1901, 148) states that "The stomachs of several specimens contained earthworms and beetles." Holbrook (1842, IV, 54) states that it feeds on "various insects."

Range: The species has been reported from; Grosse Isle (Baird and Girard, 1853, 135, 136; Cope, 1900, 1002), Michigan (Miles, 1861, 233; Holbrook, 1842, IV, 54), Ann Arbor (Smith, 1879, 7), Port Huron (Cope,

1900, 1003), Eaton County (Clark, 1902, 194), Ann Arbor, Olivet, and Antrim, Kalamazoo and Montcalm Counties (Clark, 1905, 109), sand region of Huron County, from Sand Point to Port Austin (Ruthven, 1911a, 266-267). Specimens from the following localities have been examined: Ann Arbor, Portage Lake, Pittsfield, Ypsilanti, Delhi, Washtenaw County, Iosco, Livingston County, Pontiac and Orchard Lake, Oakland County, Port Huron, St. Clair County, Lenawee County, sand region from Sand Point to Port Austin, Huron County, and Alma, Gratiot County.

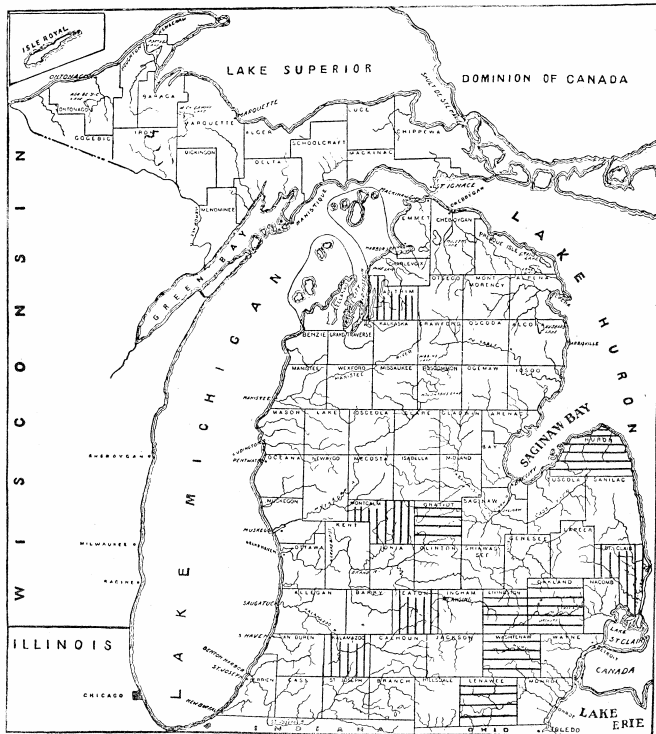


Figure 29. Distribution of *Storeria dekayi*. Horizontal ruling, specimens examined; vertical ruling, reports only.

STORERIA OCCIPITOMACULATA (Storer).

RED-BELLIED SNAKE.

Storeria occipitomaculata, Smith, 1879, 7. Clark, 1905, 109. Notestein, 1905, 114. Ruthven, 1904a, 189-191; 1906, 110; 1909, 332; 1911a, 267; Miles, 1861, 233.

Description: A small snake attaining a length of about ten inches. Head small. Muzzle short. Cephalic plates normal. Rostral normal. Sides of head high. First temporal large, those in the second row tending to fuse into a single plate. Loreal fused with posterior nasal. Nostril lateral.

Dorsal scales in 15 rows throughout the length of the body. Supralabials usually 6, rarely 5; infralabials usually 7, occasionally 6, rarely 5 or 8. Oculars generally 2-2, rarely 3 preoculars or 1 or 3 postoculars. Ventrals 115-127; subcaudals 39-48. Anal plate divided.

Color above variable; usually a chestnut-brown, it may be light or dark gray or nearly black. A paler vertebral

band margined on either side by a row of black spots or a dark chestnut band usually, but not always, present. First row of scales occasionally dark chestnut or nearly black, so that four dark bands are frequently present. Belly margined on either side by a band of gray speckled with black, the median portion red. Three (a dorsal and two lateral) yellow spots just behind the head, frequently obscure. Young when born uniformly very dark brown or black above, the nuchal spots conspicuous and the belly pink.

Habits and Habitat: The little red-bellied snake is mostly confined to woodland areas, and is very secretive, generally being found under loose stones, logs, etc. It is a very amiable little snake, and in captivity soon learns to take food from the fingers. Its food is said to consist of earthworms (Ditmars, 1907, 270), slugs (Ditmars, 1907, 270, Hay, 1892a, 498, Surface, 1906, 137-138), beetle larvae (Ditmars, 1907, 270), insects (Morse, 1904, 133).



Figure 30. Distribution of *Storeria occipitomaculata*. Horizontal ruling, specimens examined; vertical ruling, reports only.

The young are born alive and appear in small broods of from five to thirteen, the earliest date recorded being August 18 (Ditmars, 1907, 270) for a New York specimen, and the latest date September 26 (Ruthven, 1906, 111) for an Isle Royale, Michigan, specimen.

Range: The species has been reported from: Michigan (Miles, 1861, 233), Ann Arbor (Smith, 1879, 7), Porcupine Mountains, Ontonagon County (Ruthven, 1904a, 189, 191), Isle Royale, Porcupine Mountains and Kalamazoo County (Clark, 1905, 109), Porcupine Mountains, Iron County, Marquette and Isle Royale (Ruthven, 1906, 110, 111), Isle Royale (Ruthven, 1909,

332), Sand Point, Huron County (Ruthven, 1911a, 267). The writer has seen specimens from the following localities: Ann Arbor, Washtenaw County, Iron River and Crystal Falls, Iron County, Iron Mountain and Brown Lake, Dickinson County, Isle Royale, Keweenaw County, Porcupine Mountains, Ontonagon County, Marquette, Marquette County, Plainfield, Livingston County, Sand Point, Huron County, Hancock, Houghton County, Alma, Gratiot County and Dr. F. N. Notestein informs the writer that he saw it in Otsego County in 1911.

HETERODON PLATYRHINUS Latreille.

HOG-NOSED SNAKE.

(Pl. IX b.)

Coluber heterodon, Sager, 1839, 302.

Heterodon platyrhinus, Smith, 1879, 6. Clark, 1905, 110. Notestein, 1905, 118, Ruthven, 1909a, 117; 1911a, 265. Thompson, 1911, 107.

Heterodon platyrhinus niger. Smith, 1879, 6.

Description: A snake of robust build occasionally attaining the length of three feet, but usually about twenty-eight inches. Head short and rather broad. The rostral plate greatly developed and protruded upward and forward, projecting from the muzzle as the apex of a triangular pyramid; the anterior face broad and flat, the laterals slightly concave so that the lateral and dorsal edges are projecting. Internasals entirely, and prefrontals partially, separated by a narrow and elongated plate (azygous) having the form of an irregular pentagon whose sides are parallel. The azygous with more or less of a median keel (continuing from the dorsal edge of the rostral). Two large temporal scales bordering the last three supralabials and separated from the temporals by two or three rows of smaller scales. A single loreal, and two nasal plates, the nostril valvular and situated entirely in the postnasal. A single and continuous series of small plates (9, 10, 11, or 12 in number) bordering the eye on the anterior, posterior and inferior sides, occupying the place of the usual preoculars and postoculars, and separating the orbit from the supralabials.

Dorsal scale rows usually 25-23-21-19, keeled and with two pits; supralabials usually 8; infralabials 9, 10, or 11; ventrals 120-137; subcaudals 33-48; anal divided.

The ground color of the back varies from gray or yellow to red, reddish brown or black. When the color is light there are three series of spots—a vertebral row of large spots alternating with a lateral row of smaller ones on either side. Tail cross-banded above. A dark band across the head on the suture between the prefrontals and occipitals and frontal; and another from the orbit to the angle of the mouth. An elongated dark blotch on either side of the neck. Ventral surface yellow or greenish yellow, occasionally with faint blotches of brown.

In uniformly colored individuals the ground color is greenish olive to black; the ventral surface being

immaculate greenish or yellowish. In black individuals the spots are usually entirely wanting; in the olivaceous specimens the black nuchal spots are often distinct, and the vertebral and lateral ones are often faintly in evidence.

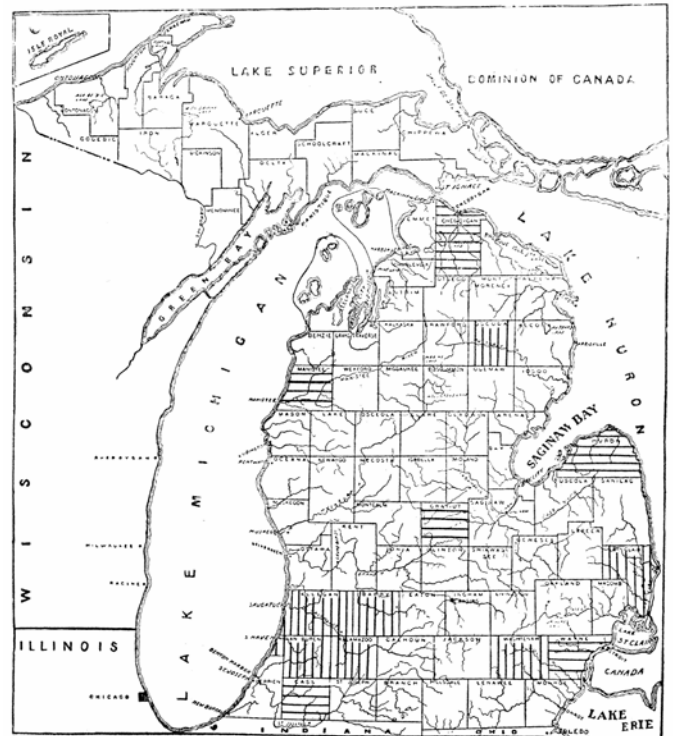


Figure 31. Distribution of *Heterodon platyrhinus*. Horizontal ruling, specimens examined; vertical ruling, reports only.

Habits and Habitat: As stated below, this species has been found in but few localities in Michigan, but the evidence seems to indicate that it prefers dry woods and occurs particularly in sandy regions. It is one of the most interesting of the northeastern North American snakes. Its stocky build and upturned snout give it a particularly savage appearance, which is greatly enhanced by its peculiar habit of flattening out the fore part of the body, and hissing loudly when disturbed. It also feigns death by throwing itself on its back, writhing as if in agony with the mouth widely opened, and then lying perfectly relaxed. It will retain this posture for a considerable time, and if turned over on the ventral surface will immediately turn over on its back again. Its formidable appearance, and the peculiar habit of flattening its body and hissing loudly have furnished the basis for the most exaggerated stories, earned for it the common names blowing adder, hognosed viper, hissing viper, etc., and given rise to the general impression that it is a very venomous and greatly to be feared serpent. As a matter of fact the eastern hognosed snake is not only entirely harmless but can scarcely be induced to bite, and makes a most interesting snake in captivity. The food seems to consist almost entirely of toads, altho we have observed them to eat frogs in captivity. Insects are often found in their stomachs, but there is no reason to believe that these are taken in any other way than in the stomachs of

the toads they have swallowed. The species is oviparous.

Range: The species has been reported from Michigan (Sager, 1839, 302, Miles, 1861, 233), Ann Arbor (Smith, 1879, 6), Wayne, Kalamazoo, Van Buren, Allegan and Barry Counties (Clark, 1905, 110), McKinley, Oscoda County, Manistee, Manistee County and Pearl Beach, St. Clair County (Ruthven, 1909a, 117), Huron County (Ruthven, 1911a, 265), and Cass County (Thompson, 1911, 107). We have seen specimens from Manistee, Detroit, the sand region of Huron County, between Bayport and Port Austin, Alma, Gratiot County, Cass County, and Douglas Lake, Cheboygan County.

From these records it seems probable that the species is to be found commonly, if not almost exclusively, in the more sandy parts of the state.

ELAPHE OBSOLETUS (Say).

PILOT SNAKE.

(Pl. VI.)

Coluber obsoletus, Sager, 1839, 301. Smith, 1879, 6. Clark, 1902, 192; 1903, 172.

Coluber spiloides (Part?), Cope, 1900, 841-843.

Callopeltis obsoletus, Clark, 1905, 110.

Coluber obsoletus obsoletus, Notestein, 1905, 117.

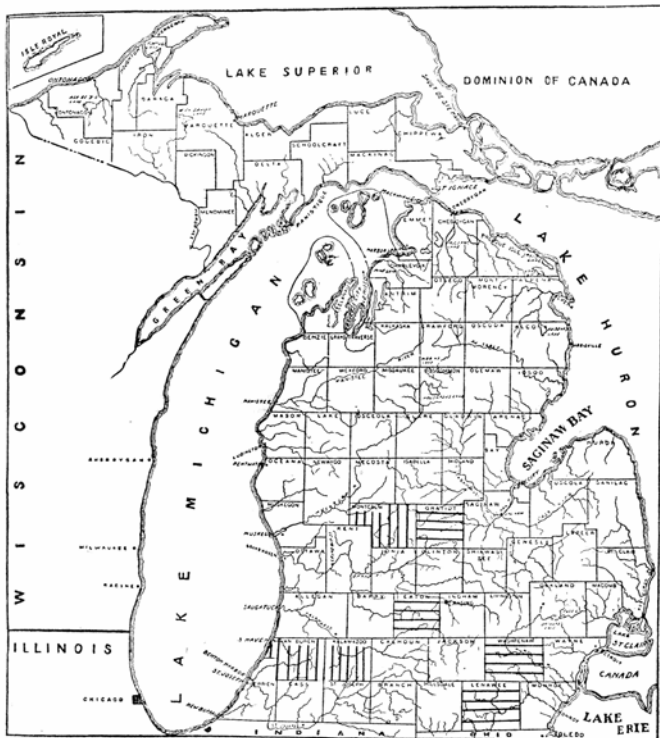


Figure 32. Distribution of *Elaphe obsoletus*. Horizontal ruling, specimens examined; vertical ruling, reports only.

Description: A large snake attaining a length of from five and one-half to eight feet. Head moderately swollen through the jaws, and tapering gradually to the end of

the snout, so that it is decidedly elongate; high on the sides; the muzzle usually straight on the sides, occasionally slightly concave in the preocular region. Eye moderate. Nostril lateral. Cephalic plates normal, the frontal plate generally longer than broad.

In the few specimens examined the dorsal scale rows are 25-23-21-19-17 and 23-25-21-19-17.* Supralabials 8, occasionally 7; infralabials 11; occasionally 12. Oculars 1-2. Temporals 2-3, occasionally 2-2. Ventrals 231-236; subcaudals 79 and 80. Anal plate divided.

A very good description of the snake is that given by Hay (1892a, 501): "In this, the general color is a black with a bluish tinge, or a pitch-black, most pronounced on the posterior portion of the body. The anterior half may be lighter, and show evidences of blotches. The whole of this part may have a decided tinge of red, this being due to the color of the skin between the scales; yet the red may run up on the bases of the scales. Occasionally the spots of the upper surface are of a decided red. The dorsal blotches extend down on the sides to about the 7th row of scales, counting the lowest. They are about 6 inches long, and are separated by the length of two scales. Alternating with these is another series which extend from the 3rd to the 7th row of scales. These spots are all feebly indicated by the sulphur yellow of the skin between the scales; and often the color is almost uniform black. There are some scales with yellow or white edges. Lower jaw and throat white. The belly is of a slate-color or black on the hinder half; anteriorly the black is mottled with yellowish, which color becomes more and more abundant, until the throat and chin are entirely yellowish. Small, or even half-grown, individuals may have a ground color of ash-gray and numerous dark blotches."

*The number of scale rows in the series is usually given as 27, so that the above formulas are probably exceeded in some Michigan specimens. Needless to say this summary of the number of scales in the different series, based as it is on a small number of specimens, is only a very general one.

This snake is often confused with the blue racer. It may readily be distinguished from the latter by the carinated scales and greater number of scale rows and the dark markings on the ventral surface.

Habits and Habitat: The writer has been unable to gather any data on the habitat of the pilot snake in Michigan. The food that the species is known to take is as follows: mice (Hay, 1892a, 503), cotton-tail rabbit (Ditmars, 1907, 305), undetermined insect fragments, undetermined larvae, insects, with bird remains, undetermined species of Orthoptera, Acridiidae (grasshoppers), wood frog, undetermined birds, undetermined eggs, chicken eggs, robin eggs, red-winged blackbird, sparrow, robin, undetermined mammals, common opossum, undetermined mice, meadow mouse (*M. pennsylvanicus*), *Microtus* sp. (uncertain species), house mouse, undetermined squirrels, red squirrels, chipmunk, undetermined shrew, and weasels (Surface, 1906, 160). In the specimen

taken at Ann Arbor by Winchell (see infra) the writer finds the remains of an adult sparrow.

The pilot snake is oviparous, Hay (1892, 395) records a pair that were taken in coitu on June 19, and Surface (1906, 159) states that the eggs are laid during the latter part of August or early part of September. Ditmars (1907, 306) writes that a specimen deposited ten eggs on June 26. Surface also states that the eggs are laid in loose earth or damp sawdust; Stejneger (1892, 396) has recorded a batch found in a hollow stump, and Hay (1892, 396) found a number in a pile of stable manure. The last named writer describes the eggs and young as follows: "When found the eggs were glued together in one mass. Each egg is 2 inches long and nearly an inch and a quarter in the short diameter. On the outside is found a thick, leathery, yellow covering, beneath which is a much thinner coat. From one of these eggs I have taken a young snake which measures ten and three-quarters inches: in length. Attached to this embryo is a considerable mass of yolk, a condition which indicates that the embryo is not ready for hatching. Nevertheless, all the generic and specific characters are well shown. There is a well developed egg tooth. The intromittent organs are everted in the specimens examined."

Range: The status of this snake in the state is little known. It has been reported from Michigan (Sager, 1839, 301, Smith, 1879, 6), Eaton County (Clark, 1902, 193, 1903, 172), Olivet, Ann Arbor, and Kalamazoo, Van Buren and Montcalm Counties (Clark, 1905, 110). The writer has only seen four specimens that were taken within our limits, one from Alma, Gratiot County, one from Eaton County, one at Ann Arbor, by Alexander Winchell, and one from Lenawee County, by W. J. Beal. Both of the latter specimens are without dates, but they have been in the University of Michigan Museum collection for many years.

ELAPHE VULPINUS (Baird and Girard).

FOX SNAKE.

(Pl. IXa.)

Coluber vulpinus, Notestein, 1905, 117. Smith, 1879, 6. Cope, 1900, 831-833.

Scotophis vulpinus, Baird and Girard, 1853, 75-76. Miles, 1861, 233.

Callopeltis vulpinus, Clark, 1905, 110.

Elaphe vulpinus, Ruthven, 1909a, 110; 1910, 59; 1911a, 266.

Description: A robust snake, attaining a length of about four or five feet. Head rather flat, broad and rather short, being usually decidedly shorter and broader than in *E. obsoletus*. Sides of head rather low, slightly concave in preocular region. Eye moderate, pupil round. Nostrils lateral. Cephalic plates normal; the frontal generally nearly or quite as wide as long.

Dorsal scale rows 27-25-23-21, 25-27-25-23-21, 25-23-21; the first 3 or 4 smooth, the others weakly keeled.

Supralabials 8, occasionally 7 or 9; infralabials 9, 10 or 11. Oculars usually 1-2. Ventrals 200-212 (196-217, Cope, 1900, 832); subcaudals 50-65 (68, Cope, 1900, 832). Anal plate divided.

Ground color above yellowish or light brown. A median series of dark chocolate brown blotches with inconspicuous black margins and separated by two scales, the first one or two anterior either entirely or partly divided on the median line. Vertebral spots usually descending to the fifth or sixth rows on the sides, the lower margin being produced in an obtuse angle. A row of smaller blotches alternating with those of the vertebral series on the sides between the second and seventh rows inclusive. These are also margined with black, and in turn alternate with another series of black blotches that involve the edge of the ventrals and the first one or two rows of dorsal scales. Belly pale yellowish with alternating series of quadrate black blotches of which the row involving the first one or two dorsal rows is the outer. Head light brown, with a dusky band across the suture of the prefrontals with the frontal and supraoculars, and another from the eye to the angle of the mouth.

Habits and Habitat: Very little is known of the habits or habitat of the fox snake. In common with some other snakes, it will, when excited, frequently vibrate the tail rapidly like the rattle snakes. As the tail terminates in a horny point, a distinct buzzing sound is produced. It is entirely harmless, and not usually pugnacious. Ditmars, 1907, 297-298) writes of the food and breeding habits as follows: "The Fox Snake feeds largely upon small rodents, young rats and mice. To procure the former it often haunts the vicinity of barns and sheds where hay or grain is stored. From this habit it is sometimes called the house snake. The fully adult individuals eat mammals as large as half-grown rabbits. They occasionally prey upon birds and will eat their eggs, swallowing them entire and breaking the shell in the throat by the contraction of the muscles. The good this species does in destroying the smaller, injurious creatures of the fields, should cause it to be the recognized friend of the farmer. One snake is worth a dozen traps, for the reptile prowls into the burrows and nests of rats and mice and eats the entire brood.

"Like all of the Colubers, the Fox Snake deposits a considerable number of eggs, generally in the hollow of a rotting stump, and leaves them without further ado, to hatch within six or eight weeks time. The eggs gradually increase in size by absorbing the moisture of the wood pulp in which they are deposited. Just prior to hatching, an egg is a third or half larger than when it was laid. One of the writer's specimens deposited 12 eggs on the first of July. They were adhesive in a single cluster. These eggs began hatching on the 21st of August, and all had not hatched until about ten days later. The female specimen was three and a half feet in length and in proportion to her size the young were very large." A specimen taken in Huron county by the writer (Ruthven, 1911a, 266) had eaten four young rabbits.

Range: The species has been reported from: Grosse Isle (Baird and Girard, 1853, 75-76), south shore of Saginaw Bay (Miles, 1861, 233), Grosse Isle (Cope, 1900, 832), St. Clair County (Ruthven, 1909a, 110), Dickinson County (Ruthven, 1910, 59), Stony Island and sand region of Huron County (Ruthven, 1911a, 266). Specimens have been examined from: Pearl Beach and Hersen's Island, St. Clair County, Stony Island and Sand Point, Huron County, Brown Lake, Dickinson County, and Monroe County. Captain C. C. McDonald, light-house keeper on Charity Island, has informed the writer that he killed a pair of these snakes in coitu on the island a number of years ago. Captain McDonald is familiar with the species, and the record can be accepted, altho the snake has not since been observed on the island.



Figure 33. Distribution of *Elaphe vulpinus*. Horizontal ruling, specimens examined; vertical ruling, reports only.

NATRIX SIPEDON (Linnaeus).

WATERSNAKE.

Coluber sipedon, Sager, 1839, 302.

Tropidonotus sipedon, Smith, 1879, 6.

Natrix fasciata sipedon, Clark, 1902, 194; 1903, 173. Notestein, 1905, 117. Cope, 1900, 969-972. Clark, 1903b. Hankinson, 1908, 236. Matrix sipedon, Kirsch, 1895, 333. Thompson, 1911, 106. Ruthven, 1911, 115; 1911a, 269.

Matrix sipedon fasciata, Clark, 1905, 109.

Natrix erythrogaster, Clark, 1902, 194; 1903, 172; 1905, 109; 1903b.

Natrix fasciata erythrogaster, Notestein, 1905, 117.

Tropidonotus erythrogaster, Smith, 1879, 6.

Nerodia agassizii, Baird and Girard, 1853, 4142. Miles, 1861, 233.

Nerodia sipedon, Baird and Girard, 1853, 38-39. Miles, 1861, 233.

Description: Medium sized snakes of robust form; size three and a half to four feet. Head decidedly swollen at the base of the jaws, rather narrow and elongate, with high and straight sides. The muzzle bluntly sub-conical, so that the nostrils are directed upward to some extent. The nostrils quite small and capable of being closed.

Dorsal scales generally 23-21-19-17; occasionally 21-23-21-19-17; more rarely 23-25-23-21-19-17, and 23-21-19-17. Labials nearly always 8-10, very rarely 9 (or 7) superior and 9 or 11 inferior scutes in the series. Oculars 1-3, with rare exceptions 1-2 or 14. Temporals 1-3 with occasionally 2 in the second row. Ventrals 137-149, subcaudals 56-75. Anal divided.

The coloration of this species has been well described by Cope (1900, 970-971): "In young individuals and in those generally in which the epidermis has been removed, the normal type of coloration is seen to consist of three series of nearly quadrate dark brown spots, with still darker borders, one dorsal and one lateral on each side. These are so disposed that the two corresponding lateral spots are opposite the intervals between the dorsals, and thus appear to be connected by a light line. The longitudinal diameter of the dorsal spots, amounting to three or four scales, is the greater; just the reverse of what is the case with the lateral. Of these lateral spots there are generally about thirty-two on each side from the head to the anus, the spaces between equal to or less than the spots, not greater, as in *T. fasciata*. While the pattern is generally quite distinguishable on the posterior half of the body, anteriorly it becomes confused, the lateral blotches standing opposite to the dorsal and becoming confluent, so that the back appears crossed by lozenge shaped blotches extending to the abdominal scutellae, and this separated on the sides by triangular intervals of a lighter color.

"Occasionally the color appears to be a dull and rather light brown, with the back crossed by narrow transverse lines, with dark (nearly black, but still not distinct) margins." Frequently the general color is so dark that the animal is more or less uniformly dark brown or black above, and in some of the black individuals the belly is red (so called variety *erythrogaster*).

Habits and Habitat: This well known snake is common along the streams and lakes of southern Michigan. It is never found far from such habitats and generally frequents logs or branches of bushes overhanging the water, into which it glides swiftly on the slightest sign of danger, and conceals itself on the bottom. On sandy and rocky shores where bushes and trees do not come down to the waters edge (for example, along the Great Lakes) it is found under logs and driftwood.

A considerable variety of food has been recorded in the stomachs of these snakes. Surface (1906, 156) records insect fragments with toad remains, undetermined species of orthoptera, two-striped grasshopper, striped brown cricket, undetermined ground beetles, undetermined vertebrates, undetermined fish, catfish, white sucker, *Cottus ictalops*, *Cottus richardsoni*, undetermined salamander, *Plethodon cinereus*, tadpole, toad, green frogs, undetermined mammals, meadow mouse (*Microtus pennsylvanicus*), common shrew (*Sorex personatus*). Atkinson (1901, 150) says that it feeds upon "crustaceans, fish, and batrachians." De Kay (1842, 42) found it feeding on the lake lamprey, bullhead, brook trout, and white sucker. Blatchley (1891, 30) removed seven leopard frogs from a single specimen. Ortmann (1906, 495) states that crawfish form an important part of the diet of this snake. Notwithstanding the variety of food which it is thus evident that the watersnake will eat, fish form by far the greater part of the diet. In the few stomachs which we have examined from southern Michigan specimens, small fish alone were found, and these often in considerable numbers.

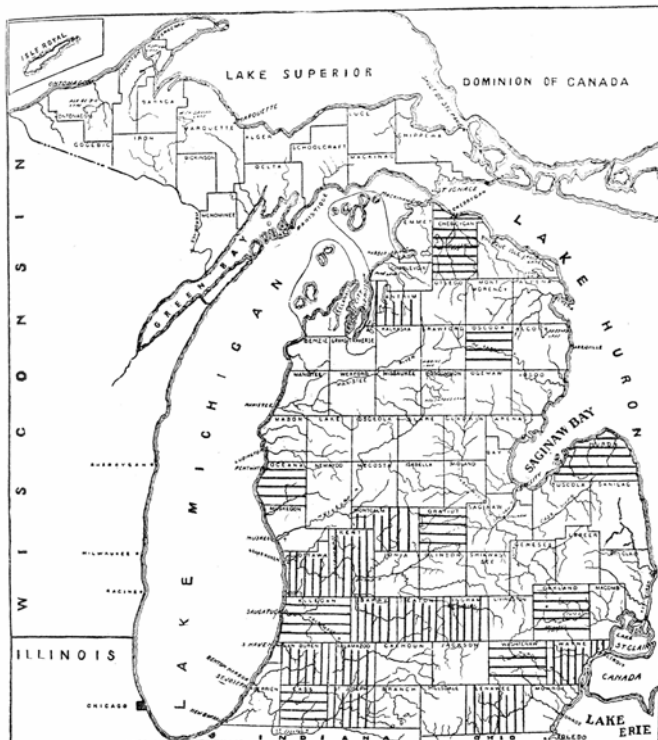


Figure 34. Distribution of *Natrix sipedon*. Horizontal ruling, specimens examined; vertical ruling, reports only.

Range: The species has been reported from: Grosse Isle and Lake Huron (Baird and Girard, 1853, 38, 39 and 42), Michigan (Sager, 1839, 302; Miles, 1861, p. 233), Ann Arbor (Smith, 1879, 6), Lansing (Cope, 1900, 97T), Hudson, Manitou Beach and Tiffin River, Lenawee County (Kirsch, 1895, 333), Eaton County (Clark, 1903, 172; 1903b; 1902, 194), Cass County (Thompson, 1911, 106), Ann Arbor, Lansing, and Olivet, and Antrim, Barry, Kalamazoo, Kent, Montcalm, Ottawa, St. Joseph and

Van Bur en Counties (Clark, 1905, 109), Huron County (Ruthven, 1911a, 269), Walnut Lake, Oakland County (Hankinson, 1908, p. 256), and Douglas Lake, Cheboygan County (Ruthven, 1911, 115). The writer has examined specimens from Walnut Lake and Pontiac, Oakland County, Washtenaw County, North and Stony Islands and the sand region of Huron County, Charity Island, Saginaw Bay, Douglas Lake, Cheboygan County, Shelby, Oceana County, Cass County, Allegan County, Oscoda County, and Alma, Gratiot County.

REGINA LEBERIS (Linnaeus).

LEATHER SNAKE.

Coluber septemvittatus, Sager, 1839, 302.

Tropidonotus leberis; Holbrook, 1842, IV, 51.

Natrix leberis, Clark, 1902, 194. Notestein, 1905, 116.

Regina leberis, Baird and Girard, 1853, 45-46. Clark, 1905, 110. Smith, 1879, 6. Miles, 1861, 233.

Description: Slender, medium sized snakes attaining a length of about two feet. Head rather flat from the nape, sides low.

Dorsal scale rows 19-17 in every specimen examined, except in a few that have 21 just behind the head. Labials usually 7-10, occasionally 7-9 or 7-11. Oculars 2-2, the preoculars rarely fused into a single scale. One anterior temporal. Ventrals 142-154, subcaudals 65-81. Anal plate divided.



Figure 35. Distribution of *Regina leberis*. Horizontal ruling, specimens examined; vertical ruling, reports only.

Ground color above uniformly dark chestnut or chocolate brown, as is also the top and sides of the head above

the labials and the lower part of the lower postoculars. A bright yellow band occupies the second and upper part of the first scale row, and is continued on the head to include the supralabials, lower part of the lower postocular and the lower part of the rostral plate. Although frequently obscure there is a narrow black line on the fifth and occasionally on adjacent parts of the fourth and sixth dorsal rows on either side and one on the median (tenth) row. Occasionally the entire area between the lower lateral line and the light lateral stripe on the second and third rows appears blackish. Ends of ventrals with the lower part of the first scale row usually brownish, forming a dark band. Belly dull yellow with, two parallel bands of brown that are broken by the narrow pale margins of the scutes and unite into a single, narrow, median band on the throat.

Habits and Habitat: Little is recorded on the habits of this snake. Morse (1904, 132) states that it is often found hanging over a stream from projecting willows from which it glides rapidly into the water when disturbed." It is apparently quite aquatic. Atkinson (1901, 149) states that in its stomach "crayfish are most frequently found, also occasionally fish and small frogs." Surface (1906, 151) examined four specimens which had eaten crayfish, and one of these had eaten a toad. Ortmann (1907, 495) states that crayfish form an important part of its diet and that he has seen it - disgorge *Canibarus obscurus* when captured.

Range: The species has been reported from: Grosse Isle (Baird and Girard, 1858, 45, 46), Michigan (Sager, 1839, 302; Miles 1861, 233; Holbrook, 1842, IV, 51), Ann Arbor (Smith, 1879, 6), Eaton County (Clark, 1902, 194), Olivet and Montcalm, Kalamazoo and Van Buren Counties (Clark, 1905, 110). The writer has examined numerous specimens from Washtenaw County, and one from the vicinity of Manistee, Manistee County.

CLONOPHIS KIRTLANDII (Kennicott).
KIRTLAND SNAKE.

Regina kirtlandi, Smith, 1879, 6.
Clonophis kirtlandi, Clark, 1905, 109.
Natrix kirtlandii, Cope, 1900, 997. Notestein, 1905, 116.

Description: A rather small snake attaining a length of about eighteen inches. Head small and pointed, sloping downward from the nape; sides not concave in front of eye, the latter small and slightly protruding. Nasal plates united above the nostril. The scutellation of the two Michigan specimens examined is as follows:

Dorsals	Supralabials	Infralabials	Oculars	Temporals	Subcaudals	Ventrals
19-17	6	7	1-2	1-2	56	134
19-17	5	7	1-2	1-2	54	130

Ground color light brown and narrowly restricted by large, conspicuous, quadrate, black blotches arranged in two rows on either side. Spots of the lower row larger; those of the two upper rows occasionally fused across the back. The first one or two scale rows light ash, like

the ends of the ventrals. Top of head marbled with black and brown. Supralabials dull yellow. A small, well defined, black spot on the outer end of each ventral scute, forming with its fellows a row of spots along either side of the abdomen. Ends of ventrals outside of spots gray finely speckled with black. Middle of the abdomen said to be red in life, in alcohol it becomes yellow.

Habits and Habitat: This snake is apparently very rare in Michigan. We have seen but two specimens, as stated below. These were both taken in a large tamarack swamp. It is said (Cope, 1900, 997; Ditmars, 1907, 262) to frequent damp woods and to be found generally under logs; also that when near it it will take to the water and dive to the bottom like a true water snake. It is reported to feed largely on small frogs and toads, and that captive specimens will eat fish (Ditmars, 1907, 262) and slugs (Atkinson, 1901. 150). The young are born alive.



Figure 36. Distribution of *Clonophis kirtlandii*. Horizontal ruling, specimens examined; vertical ruling, reports only.

Range: The species has been reported from: Ann Arbor (Smith, 1879, 6), Kalamazoo (Cope, 1900, 997) Ann Arbor and Kalamazoo (Clark, 1905, 109).

The two specimens of this snake described above were taken near Ann Arbor. They are the only ones the writer has seen.

LIOPELTIS VERNALIS (DeKay).
GRASS SNAKE.

Coluber vernalis, Sager, 1839, 302.
Liopeeltis vernalis, Smith, 1879, 7. Clark, 1902, 193; 1905, 110. Notestein, 1905, 118. Cope, 1900, 782-784. Ruthven, 1911, 115; 1911a, 267.

Chlorosoma vernalis, Miles, 1861, 233.

Description: A slender and rather small snake, attaining a length of one and one-half feet. Body about same diameter throughout, i. e., not tapering strongly toward the extremities, but the head well marked off. Cephalic plates normal in arrangement, rostral normal in form. Sides of head high, but muzzle short which tends to crowd out the plates in front of the eye. Nasals fused. Loreal when present of normal height but nearly as often absent as present; when absent it is fused with nasal. Nostril lateral.

Dorsal scale rows 15 throughout the entire length of the body, scales smooth. Supralabials usually 7, occasionally 8; infralabials usually 8, frequently 7, and rarely 9. Oculars usually 2-2, occasionally 1-2, rarely 1-3 or 2-3. Ventrals 123-134; subcaudals 71-84 (Baird and Girard cite an example with 94). Anal plate divided.

Uniformly bright green above and yellowish white beneath.

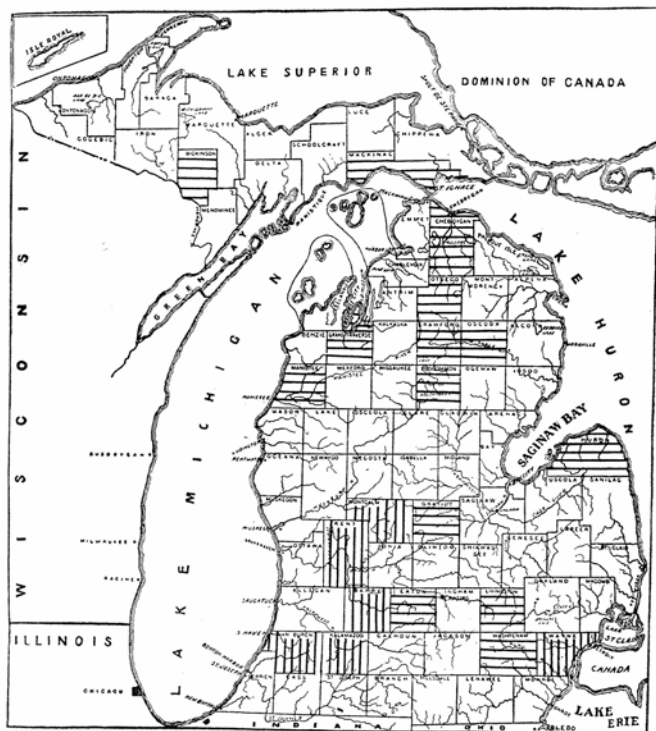


Figure 37. Distribution of *Liopeltis vernalis*. Horizontal ruling, specimens examined; vertical ruling, reports only.

Habits and Habitat: The grass snake is an exceedingly beautiful, agile, and harmless little snake that in Michigan is usually found in dry open clearings. It is generally on the ground but may climb small shrubs. The following definite observations on the food habits have appeared in the literature: snails, spiders, insect fragments, larvae, unidentified orthoptera, crickets, grasshoppers, unidentified lepidoptera, measuring worms, ground beetles (*Harpalus* sp.), red ants, striped salamander (Surface, 1906, 165-166); insects (Ditmars, 1907, 324-325); grasshoppers (Atkinson, 1901, 148); spiders, grasshoppers and crickets, but in preference to

anything of this character will take the larvae or caterpillars of certain moths" (Ditmars, 1907, 325).

Range: The species has been reported from: Michigan (Sager, 1839, 302; Miles, 1861, 233), Ann Arbor (Smith, 1879, 7), Detroit (Cope, 1900, 783), Eaton County (Clark, 1902, 193), Olivet, Ann Arbor, and Barry, Kalamazoo, Kent, Montcalm and Van Buren Counties (Clark, 1905, 110), Huron County (Ruthven, 1911a, 267) and Cheboygan County (Ruthven, 1911, 115). Specimens from the following localities have been examined: Ann Arbor, Washtenaw County, An Sable River, Oscoda County, Brighton, Livingston County, Higgins Lake, Roscommon County, Grayling, Crawford County, Traverse City, Grand Traverse County, Bad Axe and Sand Point, Huron County, Manistee, Manistee County, Douglas Lake, Cheboygan County, Brown Lake, Dickinson County, Alma, Gratiot County, Eaton County, Mackinac County, and Dr. F. N. Notestein informs me that he saw specimens in Otsego County in 1911.

DIADOPHIS PUNCTATA (Linnaeus).

RINGNECKED SNAKE.

Coluber punctatus, Sager, 1839, 802.

Diadophis punctatus, Clark, 1902, 193; 1905, 110. Notestein, 1905, 119. Smith, 1879, 7. Ruthven, 1906, 111; 1911, 114. Miles, 1861, 233. Cope, 1900, 751-753.

Description: A small snake that attains a length of about a foot or eighteen inches. Head flat and broad, low on the sides. Eye small. Two nasal plates.

The scutellation is described as follows: Dorsal scale rows 15, the scales smooth. Supralabials usually 8, often 7; infralabials 8. Oculars 2-2, temporals 1-1. Ventrals 141-146, subcaudals 36-56. Anal plate divided. In the three specimens examined by us (from Ann Arbor, Olivet and Oakland County) the scutellation is: dorsals 15 throughout the length of the body, supralabials 7-8, 7-7, 8-7, infralabials 8-8, 7-7 in two, oculars 2-2 in two, 2-1 in one, temporals 1-1 on each side, ventrals 144, 148, 159, subcaudals 57, 50, ?.

The writer has seen but one live specimen of this snake in Michigan. Hay (1892a, 493) describes the coloration as follows: "The color above varies in the subspecies, or varieties, from olive through gray to blue-black; below from yellowish white to orange and red, with more or fewer dark spots. There is usually a light ring around the neck, close to the head.

"The form in Indiana is the typical *punctatus*. The color above is a bluish black or a dark ash, with a wash of bronzy that extends down to the lowest rows of scales. Below, the color is orange or deep red, somewhat palest in front. On the outer ends of each of the ventrals there is a small black spot, and these are involved in the color of the dorsal scales. Near the middle line of the ventrals may be two rows of dark spots, or the spots on the ventrals may unite to form transverse bars. The ring

around the neck is orange, edged with black. It is one or two scales in width. Upper labials yellow."

Habits and Habitat: But little has been recorded on the habits of this snake. By far the best account is that of Ditmars (1907, 335). "The Ringnecked snake is a secretive species, hiding under the loose, rotting bark of fallen trees, among loose rocks or under flat stones. It is seldom seen abroad and if it ventures from its lairs, usually prowls at night. In the North the writer has collected large numbers of these pretty snakes by turning over flat stones. He remembers a particular stone, about the size of an ordinary platter, lying near the edge of heavy timber, in Sullivan County, New York, that appeared to be a favorite hiding place for snakes of this species. In his daily trips to the woods, this stone was always turned over, and generally to disclose a ring-necked snake, snugly coiled beneath it. Many specimens were taken at this spot. They had apparently prowled about the clearing at night and on their way back to the thicket, and its hiding places, had discovered the shelving stone.

"In the South, large numbers of these reptiles were collected by stripping the bark from fallen trees. To find fifty or more specimens during a half-days hunt for various reptiles that select such hiding places, was not unusual. The Ringnecked Snakes were most frequently found under the bark of trees infested by ants; often the working streams of these insects would pass but a fraction of an inch from the spot where the reptile lay coiled. In one instance, while pursuing some entomological investigations during the early spring, the writer exhumed one of these snakes while digging through a large and thickly populated ant kill."

The Oakland County specimen (see below) was found under the bark of a decaying stump.

It has been said to feed on the following forms: snakes, lizards, amphibians, insects and earthworms. Specific records are as follows: green snake, *Liopeltis vernalis*, and red-bellied snakes, *Storeria occipitomaculata* (Ditmars, 1907, 336); frog, *Engystoma carolinense* (Cope, 1900, 753); beetles and earthworms, (Atkinson, 1901, 148); insects (beetles and undetermined fragments), salamander, *Plethodon cinereus*, and undetermined remains (Surface, 1906, 173).

The ringnecked snake is oviparous. The following account of the breeding habits is from Surface (1906, 172). "The latent gonads or undeveloped eggs are one-fourth inch in length and commence to develop in May, when they reach a length of one-half inch, and by the middle of June they are practically developed or over one inch long. They are laid from the middle of June to July or August and each is covered with a thin opaque shell, white and leathery, and very irregular in shape and size. They hatch in September and October, and the young are about four inches in length at the time of hatching."

Range: The ringnecked snake is evidently rare in the state. The species has been reported from Michigan

(Sager, 1839, 302; Miles, 1861, 233), Ann Arbor (Smith, 1879, 7), Grayling (Cope, 1900, 753), Eaton County (Clark, 1902, 193), Olivet, Kalamazoo, Montcalm and Van Buren Counties (Clark, 1905, 110), Marquette (Ruthven, 1906, 111), Pine Lake, Oakland County (Ruthven, 1911, 114), but there is great probability that some of these records refer to young specimens of *Storeria*. The Marquette record is particularly open to question and has not been recorded upon the map. We have seen specimens from: Ann Arbor, Washtenaw County (a single specimen taken many years ago and now in the Museum), Pine Lake, Oakland County, Olivet, Eaton County, Alma, Gratiot County, and Douglas Lake, Cheboygan County, and Dr. F. N. Notestein informs the writer that he saw the species in numbers in Otsego County in 1911.



Figure 38. Distribution of *Diadophis punctata*. Horizontal ruling, specimens examined; vertical ruling, reports only.

BASCANION CONSTRICTOR (Linnaeus).

BLUE RACER.

(Pl. X.)

Coluber constrictor, Sager, 1839, 302.

Bascanion constrictor constrictor, Notestein, 1905, 119. Clark, 1905, 110. Smith, 1879, 7.

Bascanion foxii, Baird and Girard, 1853, 96. Miles, 1861, 233.

Zamenis constrictor, Clark, 1902, 193; 1903, 172-173.

Bascanion constrictor foxi, Smith, 1879, 7.

Bascanion constrictor, Baird and Girard, 1853, 93-94. Whittaker, 1905, 100-102. Miles, 1861, 233. Cope,

1900, 791-797. Hankinson, 1908, 236. Thompson, 1911, 107.

Description: A large snake that often attains a length of about six feet. Head somewhat flattened from the nape, but profile curving downward anterior to the eye, high on the sides and sides concave in front of eye. Nostril and eye large.

Dorsal scale rows 17-15 in every specimen examined. Supralabials 7, frequently 8; infralabials 8 or 9. Oculars 1-2, generally a small plate under the preocular. Temporals usually two in the first row. Ventrals 175-192; subcaudals 88-92. Anal plate divided.

Michigan specimens when adult usually uniformly dull bluish green above, rarely darker than dark olive, becoming black only on the temporal region and more or less brownish toward the end of the muzzle. Color of ventral surface nearly always greenish or bluish white, although frequently tinged with yellow.

The young differ so markedly from the adults that a superficial examination would seem to indicate that they belong to a different species, and as a matter of fact they are frequently confused with the milk snake (*Lampropeltis doliaetus triangulus*). Specimens less than one and one-half feet in length may be described as follows: ground color dark olive, this color belonging mostly to the centers of the scales, the edges being paler. A row of large blotches on the back, extending about to the fourth row of scales, about 3 to 4 scales long, and separated on the median line by about the length of half a scale. These spots with dark brown to black margins, the centers, in some cases at least, light brownish olive. Exterior to the dorsal blotches, on the first four rows of dorsal scales, numerous small and irregular black spots. Top and sides of head, and the pale ventral surface also marked with numerous small, black spots.

Habits and Habitat: The blue-racer is most frequently found in dry, open situations, generally near or in thickets. It also frequents hedge rows, and stone walls. It is a good climber and is not infrequently found several feet from the ground in bushes and twenty or thirty feet up in trees (Plate X). It is extremely graceful and agile as are all of the members of the genus, and very frequently eludes a would be captor. It will fight furiously when cornered or captured, but its small teeth can do little more than puncture the skin. As every herpetologist knows, the blue-racer is not venomous (as popularly supposed), but entirely harmless, so that even the largest specimens may be handled with impunity. Indeed they make rather interesting pets, and soon cease to resent handling. The senseless slaughter of this beautiful snake is as much a disgrace to any civilized community as is the similar destruction of song birds, and an all too common occurrence in southern Michigan. Large and conspicuous, the adults often fall prey to the ignorance and superstition of people who should know better. The writer recalls an instance when a farmer showed him with great satisfaction six splendid

specimens not one of them under five feet, which he had killed in a brush pile, under the impression that he was greatly benefiting the community by ridding it of six very dangerous animals.

The food of the blue-racer consists of small mammals, birds, bird eggs, other reptiles, amphibians and possibly insects. Exact records of stomach examinations or direct observations of the food habits are few. The principle food seems to be small mammals, and birds probably occupy a second place. Surface (1906, 170) states that in the Pennsylvania specimens examined by him the meadow mouse (*Microtus pennsylvanicus*) formed a large percent of the stomach contents. He sums up the results of an examination of a series of stomachs as follows: insects 25%; snakes (garter snakes, green snake, water snake) 15%; field mice 22%; bird eggs (robin) 8%; rabbits 4%; voles 4%; frogs (green frog, wood frog) 7½%; birds 4%; mammals unidentified 7%; larvae of Royal Moth 3½%. Atkinson (1901, 147) records a weasel in the stomach of a Pennsylvania specimen.

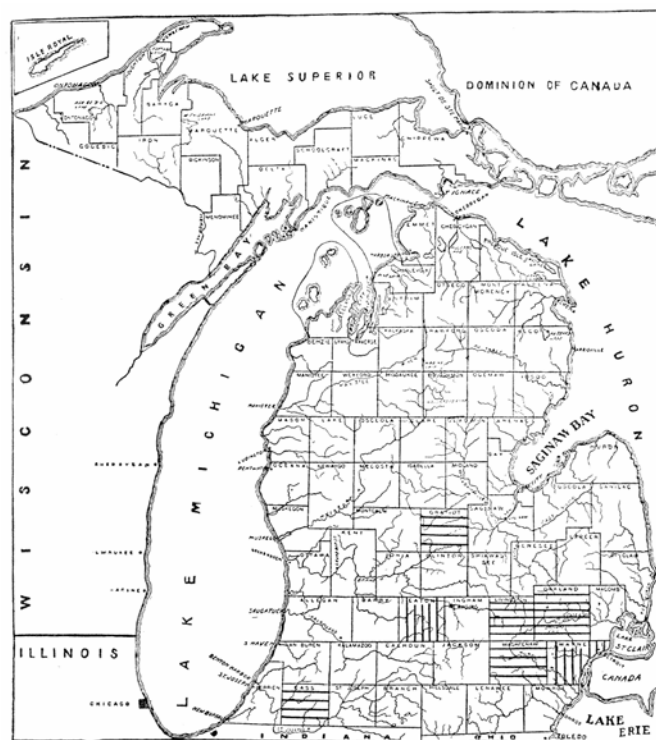


Figure 39. Distribution of *Bascanion constrictor*. Horizontal ruling, specimens examined; vertical ruling, reports only,

The writer has never been able to induce captive specimens of this snake to eat toads or frogs but that they prey on these forms to some extent is proved by the observations of Surface. It will probably be found, however, that amphibians form a very minor part of the food. Also as regards insects it is doubtful if the blue-racer preys on any of these directly except possibly the large lepidopterous larvae. That snakes are eaten is shown by the observations of Cragin (1878, 820-821), Verrill (1869, 158-159), Coues (1878, 269), Ditmars (1907, 282), Surface (1906, 168), and Putnam (1868,

136); and it is interesting to note that in the instance observed by Verrill it was a copper-head that was eaten, while the specimen observed by Coues killed and devoured a rattle-snake. This suggests that the species is, like the king-snake, immune to the poison of these venomous serpents.

Early writers supposed that this snake was a constrictor, a fact denied by some later writers. The truth is about mid-way between these views. In capturing small prey it simply seizes the animal in the mouth as do garter snakes, or at most after seizing the prey partly holds it by covering it with a portion of its body. This is exactly the same as does the king snake (*Lampropeltis getulus*), which is commonly said to be a constrictor. It is true of both species that when a snake is captured the captor winds a coil or two about the captive and thus secures it until swallowed. When a king snake captures a large mammal (e. g., a rat) it constricts it until dead, and it is possible that the blue racer does likewise.

Range: The species has been reported from: Michigan (Sager, 1839, 302; Miles, 1861, 233), Ann Arbor (Smith, 1879, 7), Eaton County (Clark, 1902, 193; 1903, 172, 173; Whittaker, 1905, 100-102), "Oceana and Muskegon to Arenac, Saginaw and St. Clair Counties and southward" (Clark, 1905, 110), Grosse Isle (Cope, 1900, 795, 797; Baird and Girard, 1853, 93-94), Walnut Lake, Oakland County (Hankinson, 1908, 236), and Cass County (Thompson, 1911, 107). We have examined specimens from various parts of Washtenaw County, from Walnut Lake, Oakland County, Alma, Gratiot County, Cass County, and the photographs (Pl. X) were made near Hamburg, Livingston County.

LAMPROPELTIS DOLIATUS TRIANGULUS (Boie).

MILK SNAKE.

Coluber eximius, Sager, 1839, 302.

Ophibolus eximius, Miles, 1861, 233.

Ophibolus triangulus, Smith, 1879, 6.

Osceola doliata triangula, Clark, 1902, 194, and 1904, 173.

Lampropeltis doliatus triangulus, Clark, 1905, 110. Notestein, 1905, 118-119. Hankinson, 1908, 236. Ruthven, 1911, 115, 1911a, 267-268.

Ophibolus doliatus triangulus, Thompson, 1911, 107.

Description: A medium sized snake, attaining a length of about three feet. Body of nearly the same diameter from the head to the tail. Head relatively small, broad and flat, as compared with the usual form as exhibited, for instance, in the garter snakes. The sides of the head are low in the milk snake so that the nasals, loreal and oculars are also low, and the whole head is short, and the eye small. Cephalic plates normal in number and form. Rostral normal. Temporals usually 2 in the first row. A single loreal. Nasals two, the nostril between them.

Dorsal scale formula usually 21-19-17; scales smooth and with two pits. Supralabials 7; infralabials usually 9, occasionally 7 or 8, Oculars 1-2. Temporals usually 2. Ventrals 195-204; subcaudals 42-51. Anal plate entire.

Ground color brownish ash or brownish yellow. Five series of dorsal blotches of which those of the median row are much the largest, broader than long and involve twelve to fifteen rows across the back. They are chestnut brown (inclining to red in the young) to olive brown in color, and bordered with black. On the sides, involving the second to fifth rows, and alternating with the vertebral series, a row of smaller circular brownish spots, and below and alternating with these another series of small black spots that involves the edges of the ventral plates and the first one to three dorsal scale rows. Belly white blotched with small squares of black. Tail crossed by half rings of black. A dark band across the posterior half of the prefrontals another from the eye to the corner of the mouth. On the nape a large spot of the ground color usually surrounded by extensions of the first dorsal blotch, these extensions uniting again on the parietals in a blotch that includes a V or heart-shaped spot of the ground color; but there are many variations from this arrangement.

Habits and Habitat: The milk snake is a rather common snake in southern Michigan, although not as frequently seen as some of the other species. Its apparent rarity is due to its secretiveness. It lives principally in and under fallen logs in the woods, but is found commonly about barns and outbuildings, probably in search of food. The name is a misnomer and originated in the popular idea that these snakes suck cows or steal milk from pans in the dairies. It is hardly necessary to state that this is an absolute fallacy. The food, as shown by examinations of stomach contents and by direct observations, is as follows: slugs, unidentifiable invertebrates, red-bellied snake (*Storeria occipitomaculata*), DeKays snake (*Storeria dekayi*), unidentifiable bird, robins eggs, unidentified mammals, jumping mouse, unidentifiable mouse, meadow mouse, *Microtus* sp?, white footed mouse, house mouse (Surface, 1906, 179-180); "Young of other snakes, besides such lizards as the blue-tailed and the swift, which it hunts at night as these creatures take refuge in the crevices of bark on fallen trees. The writer dissected a specimen that had been killed in a barn, in Sullivan County, N. Y. The stomach contained five very young rats" (Ditmars, 1907, 344); *Natrix leberis* (Queen snake) and mice (Atkinson, 1901, 150); mice *Arvicola riparia*, (Cope, 1900, 886); garter snake (Merriam, 1878); *Eumeces quinquilineatus* L. (Blue-tailed skink) and the mouse *Peromyscus bairdii* (Ruthven, 1911a, 268).

Range: The species has been reported from: Michigan (Sager, 1839, 302; Miles, 1861, p. 233), Ann Arbor (Smith, 1879, p. 6), Eaton County (Clark, 1902, p. 194), Ann Arbor, Kalamazoo and Olivet, and Antrim, Barry, Montcalm, Kent, Ottawa and Van Buren Counties (Clark, 1905, p. 110), Douglas Lake, Cheboygan County (Ruthven, 1911, 115), Oakland County (Hankinson,

1908, p. 236), Stony Island and the sand region of Huron County (Ruthven, 1911a, 267-268), Cass County (Thompson, 1911, 107). The writer has examined specimens from the following localities: Ann Arbor, Washtenaw County; Brighton, Livingston County; Jackson, Jackson County; Pontiac and Walnut Lake, Oakland County; Shelby, Oceana County; Charity Island, Saginaw Bay, Stony Island and the sand region of Huron County, Douglas Lake, Cheboygan County, Alma, Gratiot County, Osceola County, Cass County.



Figure 40. Distribution of *Lampropeltis doliaetus triangulus*. Horizontal ruling, specimens examined; vertical ruling, reports only.

THAMNOPHIS SAURITUS (Linnaeus).

RIBBON SNAKE.

(Pl. VI.)

Coluber saurita, Sager, 1839, 302.

Eutaenia sauritus, Miles, 1861, 233. Notestein, 1905, 114. Smith, 1879, 6.

Thamnotphis saurita, Clark, 1902, 194; 1905, 109. Ruthven, 1906, 112; 1908, 112-119; 1911a, 269.

Thamnophis faireyi, Kirsch, 1895, 333.

Description: A slender, long-tailed snake, attaining a length of two to two and one-half feet. Head small, distinct from neck, rather high on the sides, slightly concave in preocular region. Cephalic plates normal; two nasals; one loreal. Nostrils lateral, between nasals.

Dorsal scale rows 19-17. Supralabials usually 7, occasionally 6 or 8; infralabials 10, occasionally 9 or 11. Oculars 1-3, occasionally 1-2; temporals 1 in the first

row, and 2 in the second. Ventrals 157-169; subcaudals 87-112. Anal single.

The ground color above is usually chocolate brown, varying from light olive-brown to black. There are three light yellowish stripes—a dorsal (on the median and halves of adjacent rows) and two laterals (on the third and fourth rows)—all three of which are usually brightly colored, the dorsal generally tinged with orange, the laterals with green. The lateral black spots generally found on the skin in the garter snakes are seldom distinct, but are not always entirely fused. The ground color of the head is like that of the dorsal surface. There is usually a small pair of bright yellow spots on the suture of the parietals, and another large yellow spot on the preoculars. The labials are generally nearly white and without black markings. The belly is pale greenish and ventral spots are usually wanting.

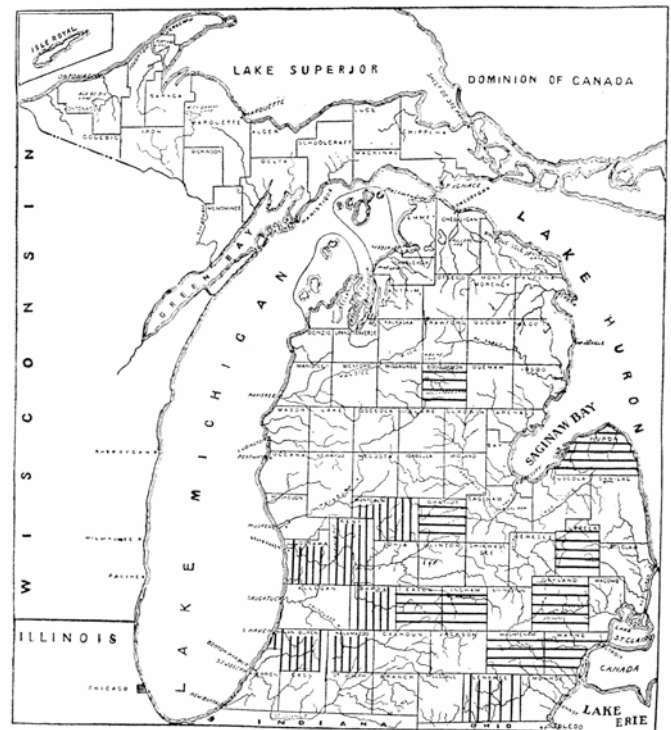


Figure 41. Distribution of *Thamnophis sauritus*. Horizontal ruling, specimens examined; vertical ruling, reports only.

Habits and Habitat: Ruthven (1908, p. 112) describes the habits of this form as follows: "Like the other members of the group, sauritus seems to be more than ordinarily aquatic in its habits, but apparently less so than either *proximus* or *sackeni*. In Michigan we have generally found it about the margin of ponds and streams in damp woods. It is somewhat of a climber, and is occasionally found in bushes, several feet from the ground. When pursued it glides through the pools and herbage at an astonishing rate, and does not hesitate to take to water and conceal itself among the water plants, but it generally remains near the surface, and we have never observed it dive to the bottom like a natricid snake. There are numerous short notes in the

literature, to the effect that *sauritus* prefers damp situations.

"Ditmars (1907, 217-219) states that it feeds on salamanders, tadpoles, frogs, and fish, but, like *sackeni*, refuses earthworms. Two other writers, Atkinson (1901, 151) and Surface (1906, 142-143), record insects in stomachs examined. The latter gives the following as making up the stomach contents of Pennsylvania specimens: Earthworms, spiders, insect fragments, ants, *Plethodon cinereus*, *Spelerpes bilineatus*, *Hyla versicolor*. It should be noted that the insects may have been contained in the stomachs of the frogs and salamanders. The number of young is comparatively small; we have counted the embryos in a few specimens, and they seem to average about a dozen."

Range: The eastern ribbon snake is not very common in Michigan, at least it is rarely taken by collectors. It has thus far only been found in the southern peninsula. The specimen from Roscommon County, listed below, is the most northern record. A specimen has been recorded from Isle Royale in the museum catalog (Ruthven, 1906, 112), but this record is very doubtful and has not been indicated on the map. It has been reported from: Michigan (Sager, 1839, 302; Miles, 1861, 233), Hudson, Lena wee County (Kirsch, 1895, 333), Ann Arbor (Smith, 1879, 6), Eaton County (Clark, 1902, 194), Ann Arbor, Olivet, and Barry, Kalamazoo, Kent, Montcalm, Ottawa and Van Buren Counties (Clark, 1905, 109), Roscommon, Gratiot, Eaton, Washtenaw, Lapeer, Ingham Counties (Ruthven, 1908, 112), the sand region of Huron County from Sand Point to Port Austin (Ruthven, 1911a, 269). Specimens from the following localities have been examined: various parts of Washtenaw County, Pontiac and Walnut Lake, Oakland County, Detroit, Wayne County, Alma, Gratiot County, Eaton County, Lapeer County, and Lansing, Ingham County.

THAMNOPHIS BUTLERII (Cope).

BUTLER GARTER SNAKE.

Eutaenia brachystoma, Clark, 1903a, 1904, 194.

Eutaenia butleri, Notestein, 114.

Thamnophis butleri, Clark, 1905, 109. Ruthven, 1904, 289-299; 1909a, 116; 1908, 87-96; 1911a, 268-269. Whittaker, 1905.

Description: A small rather thick-bodied snake attaining a length of about twelve inches. Head small and usually not very distinct from neck, somewhat elevated behind, and sloping quickly down to the point of the snout. Muzzle short. Sides of head moderately high, concave in preocular region. Eye small. Cephalic plates normal; two nasals and one loreal. Nostril lateral, between the nasals.

Dorsal scales usually 19-17, occasionally 17-19-17 or 17-19-17-15. Supralabials 6 or 7, rarely 8, average between 6 and 7; infralabials 6, 7, 8, 9, or 10, average between 8 and 9. Temporals 1 in first row and 1 large or

1 large and 1 small in second row. Ventrals 134-146 (males), 132-140 (females), subcaudals 61-66 (males), 49-58 (females). Anal plate single.

Ground color above some shade of dark olive brown, with three (a dorsal and two lateral) bright yellow or greenish yellow stripes. The dorsal stripe is usually on the median and halves of the adjacent rows, and the laterals upon the third and more or less of the second and fourth rows. The color of the first and adjacent half of the second rows of scales is generally not lighter than the ground color above. There are two rows of black spots on the skin—encroaching on the scales along the stripes in specimens light enough to show them—but these often lose their identity by fusing irregularly. Belly pale greenish, the only markings being a small black spot at either end of each ventral scute.

Habits and Habitat: The following account of the habits of this snake is taken from the monograph of the genus by the writer (Ruthven, 1908, 89-91): "In southern Michigan I have only taken it in the immediate vicinity of water, either about the margin of swampy places or on the banks of streams. This may be a coincidence, but it is in accord with all of the specimens collected throughout the range which have habitat data. I have found them most frequently by overturning boards, etc., in such places, although they are also found crawling about in the long grass and herbage.

"It is in disposition a rather sluggish snake, seldom attempts to defend itself, and when surprised is usually easily captured. The ease with which they are captured is in part due to their inability to escape, owing to the extreme awkwardness of their movements on land. When moving slowly this is scarcely noticeable, but when they attempt to move rapidly to escape capture their efforts are peculiarly odd and ineffective. The movements consist in throwing the body in long curves in a manner closely analogous to the wiggling motion by which garter-snakes swim in deep water, and which results in much movement and muscular effort, but very little progress. This movement may be greatly augmented by putting the snake on a smooth surface, but it is not entirely due to the nature of the surface, as it can scarcely make any headway on a surface where *sirtalis* will glide away with comparative ease. This is one of the most striking characteristics of *butleri* and was first noticed by Reddick (1895, 261), who comments upon it in the following words: 'It is short and chubby, and its movement is very characteristic of it. It does not have the gliding movement of *E. saurita*, nor the swift and active movement of the *Natrix sipedon*, but seems rather to exert a large amount of force to do little crawling. The movement is so characteristic that I believe anyone having once seen the peculiar way in which it tries to hurry itself away would ever after be able to recognize it at a distance.'

"Fortunately no doubt attaches to the species which Mr. Reddick had, for the specimen upon which this observation was based has been examined, and it is unquestionably a *butleri*. The movement seems to be

very similar to the method of locomotion described for the so-called *atrata* specimens of *ordinoides* by Ditmars (1907, 227).

"Observations upon the food habits of *butleri* are but fragmentary. As announced in 1904, it is fond of earthworms and small frogs, but I have since found that in captivity it apparently prefers small fish. As a rule it is impossible to get them to take either worms or frogs if dead, but it is apparently a matter of unconcern to them whether the fish be alive or dead, as they will greedily eat specimens of the latter which have begun to decompose. Young individuals four or five days old will eat as many as three or four small minnows successively.

"Females taken in July are usually pregnant, and the number of young is apparently small. In the specimens examined the number of embryos is about twelve to fifteen. One specimen which was taken in late July, 1905, and kept in captivity gave birth during the first part of August to ten young. The members of this brood were not all born on the same date, but appeared at different times between August 7 and 20, a difference of thirteen days. This is an unusual occurrence among the garter-snakes, and is undoubtedly abnormal, for, as far as we have observed, it has been invariably the rule that the entire brood appeared within a few hours at most. We have seen but one other specimen give birth to young, and there were four in this brood. The young when but a few days old will struggle eagerly with earthworms or minnows, capturing the latter in a small dish of water or taking them from the fingers. For the first three or four days they are very secretive and can be seen only by overturning the moss and stones in the cage, except when they come out to feed. They have not been observed to feed during the first three days, but after this they will come out freely to gorge themselves on fish, returning again beneath the stones when satisfied. One of these young snakes was kept for three months, in which time it attained to the respectable length of 150 mm."

An additional observation on the food-habits was made in 1908, when several leeches were taken from the stomach of a specimen taken under a stone on the shore of Stony Island, Huron County (Ruthven, 1911a, 268). In nature the form probably subsists largely on such weak food.

Range: *Thamnophis butleri* is rather common in southern Michigan as far north as the tier of counties represented by Eaton, Oakland and Ingham. A few specimens taken by the State Biological Survey on the south side of Saginaw Bay (Rush Lake and Stony Island, Huron County) in 1908 represent the most northern record, and they were apparently rare in that region (Ruthven 1909a, 116; 1911a, 268). It has been reported from Olivet, Eaton County (Clark, 1903a, 83-88), Brighton, Livingston County, Washtenaw County, Eaton County (Ruthven, 1904), Pontiac, Oakland County (Ruthven, 1908, 92), and Ann Arbor and Chelsea, Washtenaw County (Clark, 1905, 109).



Figure 42. Distribution of *Thamnophis butleri*. Horizontal ruling, specimens examined; vertical ruling, reports only.

THAMNOPHIS SIRTALIS (Linnaeus).*

GARTER SNAKE.

(Pl. XII.)

Coluber sirtalis, Sager, 1839, 302.

Thamnophis sirtalis, Clark, 1905, 109; 1902, 194. Kirsch, 1895, 333. Ruthven, 1909, 332-333; 1908, 176-186; 1911, 115; 1911a, 268. Hankinson, 1908, 236. Thompson, 1911, 106.

Eutaenia sirtalis sirtalis, Notestein, 1905, 115. Ruthven, 1904a, 189-191. Cope, 1900, 1069-1074.

Thamnophis sirtalis sirtalis, Ruthven, 1906, 31, 34, 36, 49, 50, 111. Sperry, 1903, 175-179.

Eutaenia sirtalis ordinatus, Notestein, 1905, 115.

Eutaenia sirtalis parietalis, Notestein, 1905, 115. Smith, 1879, 6.

Thamnophis sirtalis parietalis, Ruthven, 1906, 49, 50, 53, 111-112. Clark, 1902, 194. Sperry, 1903, 175-179.

*Although recorded from the state the western subspecies *T. s. parietalis* does not occur within our limits. Nevertheless some Isle Royale specimens have the interspaces between lateral spots generally suffused with red, showing a strong tendency toward the western variety (Cf. Ruthven, 1906, 111-112.)

Description: A medium sized snake attaining a length of one and a half to two or three feet. Head generally well elevated behind, elongate, high and straight on sides, concave in preocular region. Cephalic plates normal. Two nasals and one loreal; nostril lateral and between the two nasals.

Dorsal scales 19-17, supralabials 7, occasionally 8, much more rarely 6; infralabials 10, occasionally 8, 9 or 11. A single preocular and usually 3 postoculars. A single anterior temporal. Ventral plates 144-168; subcaudals 54-84. Anal plate single.

The coloration consists of three light stripes on a darker ground, the lateral stripes on the second and third rows, the dorsal on the median and halves of the adjacent rows. The first row of scales much lighter than the ground color above, usually greenish or yellowish, at least the upper half. The color between the stripes may be uniformly black or brown, or olivaceous with two rows of alternating, usually poorly defined, black spots. Regardless of the color of the scales between the stripes, however, there may nearly always be seen, on stretching the skin, two rows of prominent black spots separated by pale interspaces. Along the lateral stripes the interspaces may occasionally be red. The stripes may be yellowish, greenish or bluish, and the laterals when greenish or bluish frequently blend with the first row. The dorsal stripe sometimes wanting. The ventral surface usually pale and free from prominent markings, except for a black spot on each end of the ventrals.

Habits and Habitat: Ruthven (1908, 177-179) has summarized the habits of this species as follows: "The experience of the writer indicates that it is quite generally distributed in the Eastern forest region, for while it is found most commonly in the vicinity of water, it is not uncommon in the clearings, woods, and thickets on the neighboring hills.

"The food consists principally of frogs, toads, salamanders, earthworms, and various insects. Whether or not it feeds to any great extent upon tadpoles and fish is undetermined. Garman (1892, 268) states that they eat these animals, and I have observed them to "capture fish in captivity, but since in the wild state they are not particularly aquatic, the truth of the matter is probably that they capture these forms when they encounter them in small pools, but that this is comparatively seldom. The number and kinds of insects eaten is also a questionable point. It is true that many species are found in the stomachs examined, but, as Surface (1906, 149) says, many of these are 'taken inside of the toads and other batrachians which the garter-snake had eaten.' However, both adults and young are very fond of earthworms. As other garter-snakes, *sirtalis* apparently does not refuse dead food. Mr. N. A. Wood, of the University of Michigan, reported to the writer, on May 18, 1907, that he saw a specimen of this species swallowing a yellow warbler, which he had observed lying dead in the same place on the preceding day. In the latter part of October, 1907, the writer discovered an individual at Portage Lake, Washtenaw County, Michigan, busily engaged in an attempt to swallow the dried remains of a large green frog (*Rana clamitans*).

"The breeding habits have been commented upon several times, but are as yet only incompletely known. In southern Michigan copulation takes place in April, and

at this time it is reported on good authority that these snakes often collect in groups, probably owing to the procreative impulse. I have not witnessed this nor can I find any observations on the act of copulation. The latter I have seen but once, and then but imperfectly. It took place on April 21, 1906, between two specimens in captivity. The male in this case lay at full length beside the female, and evidently attempted to excite her by gently rubbing her neck with his snout. He finally threw a fold of his tail across hers, and turning his ventral surface against her side began spasmodic contractions of the abdominal muscles, which were continued from twenty to thirty minutes. Unfortunately the snakes were then disturbed and the observations ceased. They indicate, however, that there may be some interesting courtship reactions to be observed in these snakes.

"The period of parturition extends from the latter part of July to about the middle of September. Both of these dates are only approximate, as definite observations are wanting. The number of young is very variable, the average range in number being probably about 10-30, while as many as 78 have been recorded in a single brood, which is not at all an unusual number, since parietalis may have, according to our observations, as many as 73. After birth the young remain for a short time about the mother, but this time is probably limited to a few hours at most. In captivity there is little tendency discernable to stay near the mother, and although we have several times seen a mother and her brood in a wild state, in every case noted, when the mother became alarmed, or for some other reason moved away, the young scattered in all directions, and it is improbable that they ever came together again. The quickness and completeness with which the little snakes disappear when alarmed may partly explain the fable that this snake swallows its young.

"Ditmars (1907, 235-236) gives the following interesting account of the hibernating habits:

The favorite situations in which to pass the cold months are in soft soil on a slope that faces the south. Here the reptiles burrow down a yard or more. Rocky situations are often selected, and among the clefts and fissures, one opening into another, the snakes are enabled to retire to a considerable depth from the surface.

'It is in the fall that these snakes congregate in large numbers on ground that is suitable for the winter's sleep. Here they sun themselves during the middle of the day, retiring into clefts and burrows during chilly autumn nights. As the nights become colder, their basking periods during the day are shortened, and finally, after the first severe frost, they remain below the ground for the winter. Instinct seemingly attracts them to these places of hibernation, for such spots are usually poor feeding grounds and have been devoid of snakes during the summer months. In spring, the breeding time, the reptiles remain in numbers until the weather has become well settled and the danger of needing good shelter from the cold spells has passed. Then they scatter into the ravines, the thickets, along streams and brooks, until the

scene that has abounded with sinuous, crawling life is deserted.'

"This account harmonizes very well with the writer's observations in southern Michigan. In the latter region they are found in the autumn on sunny hillsides in the immediate neighborhood of holes, into which they hasten when alarmed, but that they dig these holes themselves yet remains to be proven, nor after the beginning of the period of hibernation do they necessarily 'remain below the ground for the winter,' for if periods of marked moderation in the temperature occur they will come out in December, January, or February. Thus, on January 22, 1906, which was a warm day (60° F.) in a period of very moderate temperature, a collector for the University of Michigan Museum reported seeing a large garter-snake near Grass Lake, Washtenaw County, Michigan, which was undoubtedly this species."

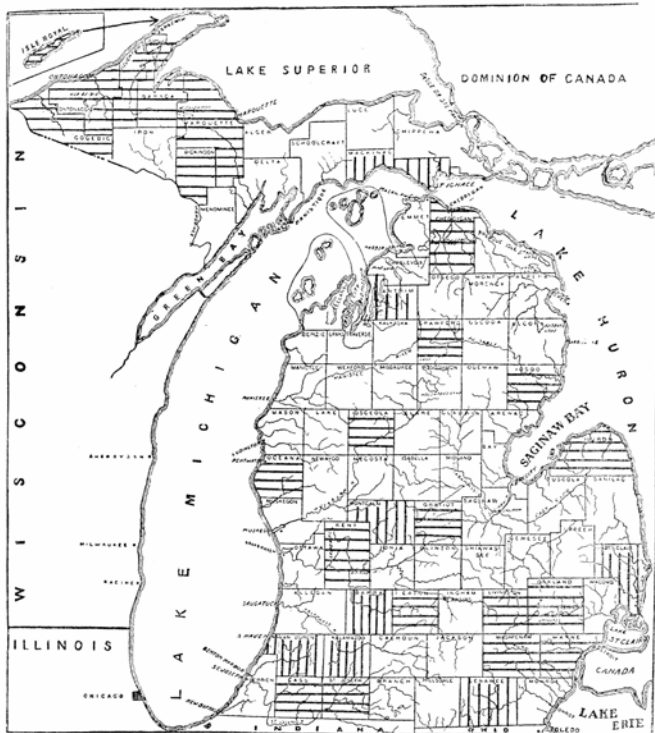


Figure 43. Distribution of *Thamnophis sirtalis*. Horizontal ruling, specimens examined; vertical ruling, reports only.

Range: The species has been reported from: Michigan (Sager, 1839, 302; Miles, 1861, 233), Ann Arbor (Smith, 1879, 6), Hudson and Manitou Beach, Lenawee County (Kirsch, 1895, 333), Grosse Isle and Port Huron (Cope, 1900, 1073), Eaton County (Clark, 1902, 194), Porcupine Mountains, Ontonagon County (Ruthven, 1904, 189, 191), Ann Arbor, Olivet, and Antrim, Barry, Kalamazoo, Kent, Mackinac, Montcalm, Ottawa and Van Buren Counties (Clark, 1905, 109), Bessemer, Gogebic County, Isle Royale, Keweenaw County, Limestone Mountain, Baraga County, Marquette, Marquette County, Porcupine Mountains, Ontonagon County (Ruthven, 1906, 111-112), Washtenaw County, Kent County, Grosse Isle, Wayne County, Livingston County, Eaton County, Oakland County, Oceana County, Crawford

County, Iosco County, Gratiot County, Isle Royale, Lake Superior, Ontonagon County, Gogebic County, Houghton County, Baraga County, Marquette County (Ruthven, 1908, 181), Walnut Lake, Oakland County (Hankinson, 1908, 236), sand region of Huron County (Ruthven, 1911a, 268), Douglas Lake, Cheboygan County (Ruthven, 1911, 115), and Cass County (Thompson, 1911, 6). Specimens from the following localities have been examined: Alma, Gratiot County, Washtenaw County, An Sable River, Crawford County, south branch of An Sable River, Iosco County, Bessemer, Gogebic County, Walnut Lake, Pontiac and Birmingham, Oakland County, Brighton, Iosco, Livingston County, Denton, Wayne County, Isle Royale, Keweenaw County, Limestone Mountain, Baraga County, Marquette, Marquette County, Porcupine Mountains, Ontonagon County, Shelby, Oceana County, Winona, Houghton County, Eaton County, Kent County, Grosse Isle, Wayne County, Douglas Lake, Cheboygan County, Brown Lake, Dickinson County, Charity Island, Saginaw Bay, sand region from Sand Point to Port Austin, Huron County, Cass County, Osceola County, and Dr. A. S. Pearce observed specimens in St. Joseph County in the spring of 1909.

SISTRURUS CATENATUS (Rafinesque).

RATTLESNAKE, MASSAUGER.

(Pl. XI b.)

Crotalus tergeminus, Sager, 1839, 302.

Caudisoma tergimina, Gibbs, 1900, 12-13.

Sistrurus catenatus, Clark, 1902, 194, 1905, 110. Stejneger, 1893, 413. Ruthven, 1911a, 270-271. Thompson, 1911, 107.

Sistrurus catenatus catenatus, Notestein, 1905, 120. Cope, 1900, 1146-1149.

Crotalophorus tergeminus, Baird and Girard, 1853, 14-15. Smith, 1879, 6.

Crotalophorus kirtlandi, Holbrook, 1842, III, 32.

Crotalophorus tergeminus kirtlandi, Smith, 1879, 6. Miles, 1861, 233.

Description: A short thick-bodied snake attaining a length of two and one-half or three feet. Head broad and decidedly triangular in shape, being much swollen through the back part, and terminating in a blunt snout. Generally a slight concavity in the frontal region. Cephalic plates normal in arrangement, but parietal plates small, which together with the broad head and a rather well defined canthus rostralis makes the area covered by the cephalic plates broadly oval in outline. Sides of head high and without or with only a slight concavity in the loreal region. Eye small, situated high up on head, with an elliptical pupil, and over-hung by the supraoculars. A deep pit in the loreal region. Temporal region occupied by four or five rows of smooth scales. Tail terminating in a rattle.

Dorsal scale rows usually 25-23-21-19, frequently 23-21-19). Supralabials 11-13 in number, separated from the orbit by a row of small scales that is continuous with the postoculars; infralabials usually about 11 to 14. Two preoculars, elongated anteriorly, the upper meeting the posterior nasal scute. Loreal small and trapezoidal in form. Ventrals 134-147; subcaudals 22-30, undivided. Anal plate single.

Ground color above grayish or ash, relieved by several series of deep brown blotches that form cross bands on the tail. Spots of the dorsal series large, and transversely and irregularly oblong in form. Below and alternating with the vertebral row a row of small rounded spots, and below these a series of large blotches transversely oblong and extending to the second row of scales, and alternating with these another series of small spots on the first and second scale rows. Spots of all of the series, with the exception of the row of small rounded blotches exterior to the vertebral series, margined with an inner black and an outer pale yellow line. Dorsal blotches occasionally divided or fused with the upper row of lateral spots. A pair of elongated spots similar to the other dorsal spots in color extend from the cephalic plates to the neck, and another on either side extends backward from the orbit. Inferior yellow margin of the latter well developed between the eye and the angle of the mouth forming a narrow yellow band. Two diverging yellow lines from the pit to the lip. Head dark brown, as the dorsal blotches, but with a light brownish band between the eyes and occasionally light marks on the posterior head plates. Color underneath Mack irregularly broken up with pale yellow.

Habits and Habitat: The rattle snake, or massauger, as it is generally known, is the only poisonous snake in Michigan; a statement which when generally known should stop the wholesale destruction of the harmless snakes practiced by most persons who come in contact with them. Needless to say this snake should be avoided as it is distinctly venomous, but on the other hand most of the current stories about it must be discredited for it is doubtful if its bite is sufficiently noxious to kill a healthy adult. It is a sluggish snake, slow to bite, and usually gives warning with its rattle before striking. It is thus little to be feared.

It prefers the vicinity of swamps, although not aquatic in its habits, and is becoming yearly more rare in this region. Its extinction is probably due to several causes chief of which is the draining of swamps and the killing of great numbers by farmers. An excellent general account of the habits of the species is given by Hay (1887).

Very few observations have been made on the food habits of this snake. Taylor (1892, 357) writes on the subject as follows: "The contents of the stomachs of this species shows that its food is almost wholly made up of mice and animals of that class. Aside from well known venomous qualities this snake has no bad habits and is decidedly useful. It is said that rats and mice will very soon disappear when the presence of this reptile is known. In at least one instance we have known this

statement to be true. It was noticed that rats which a few days previous had been extremely numerous in a certain cellar had wholly disappeared. Within a few days more the mystery was solved by finding a huge rattler in the doorway. These facts fully account for the frequent finding of rattlers around old cellars, buildings, etc., where they go to hunt for their choice food." Ditmars (1907, 438) states that his captive specimens "would take young birds, mice and frogs, and, like the copperhead snake, different kinds of food according to the seasons, a trait probably developed by necessity while in the wild state."

Our observations on the food habits of the species differ from those of Taylor in that frogs form the bulk of the stomach contents in the specimens we have examined. We have also found in two instances snakes (one a rattlesnake) in stomachs examined, and in one case it was evident that the snake eaten had been dead for a considerable time before it was eaten (Ruthven, 1911a, 270).

The young are brought into the world alive, i. e., the eggs are not laid. There are, according to Hay, usually about six young in a brood, and they are about six inches long.

Many erroneous opinions are current concerning this snake. Among these are that the number of rattles indicates the age of an individual, one rattle being added each year. The researches on the growth of the rattle all agree that each ring represents the epidermis shed from the enlarged portion of the tail, in a manner analogous to the general shedding of the skin, the new ring being added at the base each time, thus pushing the string outward. There is some disagreement among observers as to whether or not the two processes always take place at the same time, but the fact is well established that the shedding of the epidermis from the terminal enlargement of the tail and the consequent formation of rattles, like the general shedding of the epidermis, takes place every few (two-five) months, so that several rattles are usually added each year. The reason that so few rings are generally present at one time is that the terminal ones are easily and frequently lost. The number of buttons even on the largest individuals is rarely more than eight or nine, and the long strings occasionally exhibited as curiosities are in most instances formed by the joining together of several strings.

Another popular fallacy regarding these snakes is that the extraction of the fangs renders them harmless. It is true that it does so for a time, but, as is it well known to scientists, new fangs soon replace the old ones when the latter are broken off or shed. This is in fact a wise provision of nature, since the long fangs are occasionally broken off by the struggles of the prey.

The writer will not take space to describe further the characteristics of this snake. A most excellent account may be found in Stejneger's "The Poisonous Snakes of North America" (1893, 413).

Range: The species has been reported from: Michigan (Sager, 1839, 302; Holbrook, 1842, III, 32; Miles, 1861, 233; Stejneger, 1893, 413, Grosse Isle (Baird and Girard, 1853, 14, 15), Ann Arbor (Smith, 1879, 6), New Buffalo, Berrien County (Cope, 1900, 1149), Eaton County (Clark, 1902, 194), Benzonia to Au Sable River (Clark, 1905, 110), Cass County (Thompson, 1911, 107), and Huron County (Ruthven, 1911a, 270-271).

We have seen specimens from Alma, Gratiot County, Au Sable River, Oscoda County, Pontiac, Oakland County, various localities in Washtenaw County, Charity Island, Saginaw Bay, Cass County, Stony Island, North Island and Sand Point, Huron County.

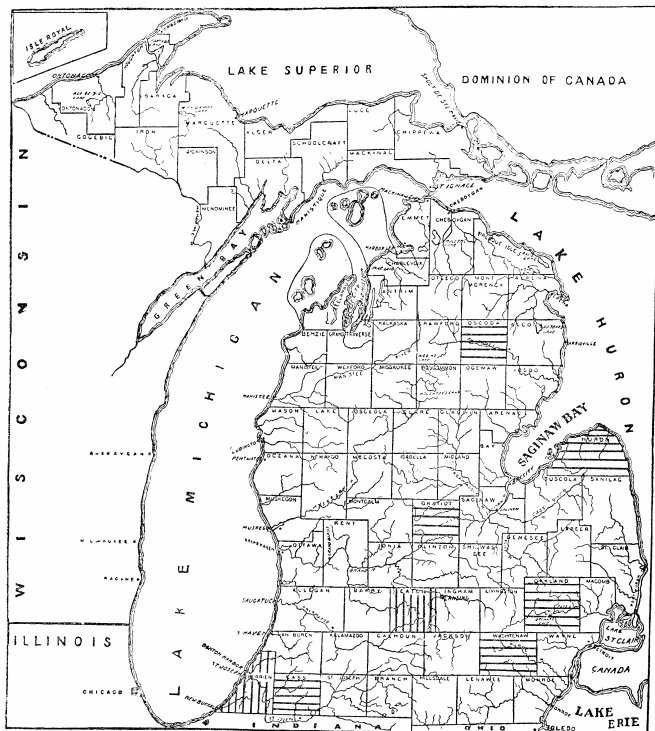


Figure 44. Distribution of *Sistrurus catenatus*. Horizontal ruling, specimens examined; vertical ruling, reports only.

ORDER TESTUDINATA. (TURTLES).

As indicated by the key (p. 77) the members of this order are quadrupedal, cuirassed forms with a rounded or longitudinal anal opening. The shell in our species is, with the single exception of the soft-shelled turtle, covered with large dermal plates. Siebenrock (1909) divides the order into four superfamilies only two of which have representatives in Michigan. It is sufficient for our purposes to diagnose the genera and species.

Key to the Genera and Species of Michigan Turtles

- a¹. Carapace covered by leathery skin, and without horny epidermal plates *Platypeltis spinifera*, p. 129.
- a². Carapace rigid and covered with horny epidermal plates.
 - b¹. Plastron narrow, not nearly filling the opening of the carapace.
 - c¹. Bridge long and narrow. Tail long and furnished above with a median row of large horny tubercles. Marginal scutes 25.... *Chelydra serpentina*, p. 133.
 - c². Bridge short and rather wide. Tail in males with a terminal nail, and without a median dorsal row of tubercles. Marginal scutes 23..... *Kinosternon odoratum*, p. 137.
 - b². Plastron nearly or quite filling the opening of the carapace. Marginal plates 25.
 - c¹. Parts of plastron immovably attached to each other and to the carapace.
 - d¹. Carapace smoothly rounded, i. e., with no median dorsal keel.
 - e¹. A sharp tooth on either side of the notch at the symphysis of the upper jaws. Carapace without round, bright orange spots, *Chrysemys*.
 - f¹. Vertebral and costal scutes unicolorous except for a yellow margin. A relatively small plastral blotch along the median line..... *C. cinerea*, p. 141.
 - f². Vertebral and costal scutes marked with irregular pale-yellow lines. A large blotch covering most of the plastron *C. bellii*, p. 143.
 - e². No teeth bounding the notch at the anterior end of the upper jaws. Carapace marked with numerous, round, bright orange spots. *Clemmys guttata*, p. 147.
 - d². Carapace with a strong median keel..... *Graptemys geographica*, p. 150.
 - c². Plastron with a transverse hinge, and movably attached to the carapace.
 - d¹. Upper jaw notched in front. Carapace long and depressed..... *Emydoidea blandingii*, p. 153.
 - d². Upper jaw produced downward at the symphysis to form a hook. Carapace short and high.... *Terrapene carolina*, p. 155.

PLATYPELTIS SPINIFERA (LeSueur).

SOFT-SHELLED TURTLE.

(Pls. VII, XIa)

Aspidonectes spinifer, Smith, 1879, 7. Clark, 1902, 193; 1905, 110. Miles, 1861, 233. Agassiz, 1857, 404-405.

Trionyx spiniferus, Thompson, 1911, 107.

Description: Body broad and very flat. Carapace and plastron not covered with epidermal plates, but by a soft and leathery skin, the margins of the carapace bending freely at the edges. Head tapering to the snout which is much produced and flexible. Nostrils separated by a septum, and each with a papilla projecting into it from the septum. A low obtuse keel along the middle of the back. A series of spines along the anterior edge of the carapace, in the adults; the entire upper surface of the carapace covered with small tubercles. Feet broad and fully webbed.

Color of carapace olive or light brown, the margin yellow. Near the margin is a narrow, broken line of black. In young specimens there are on the carapace numerous spots somewhat darker than the ground color and each surrounded by a broad, black ring. These spots become

smaller and entirely black toward the margin of the carapace, and are obscure in old individuals. Plastron immaculate white or pale yellow. Limbs olive spotted with black. A pair of black lines on the snout, each of which at the base of the latter become two diverging black lines separated by yellow, and pass through the eye onto the neck.

Habits and Habitat: In southern Michigan the soft-shelled turtle occurs rather commonly in the rivers and lakes which have a soft muddy bottom. They are not commonly seen, as they seldom leave the water, and owing to the fact that the color of the carapace harmonizes well with the color of the bottom. When surprised, they are rapid swimmers and easily elude capture. The larger individuals should be handled with care as the lip-like folds of skin cover sharp-edged mandibles that are capable of inflicting considerable injury.

Newman's (1906, 126 *et seq.*) observations on the habits of the soft-shelled turtle at Lake Maxinkuckee, Indiana, are the most comprehensive that have been made and are largely the basis of the following very brief account.

They appear early in April (or in the latter part of March), from their hibernation, and soon begin to feed actively. In food habits it "is voracious and carnivorous, feeding principally upon crayfish and the larvae of large insects. From the vantage ground of a high bank it was possible on still days to observe individuals as they captured their prey. They crawl or swim along the bottom, thrusting their snout under stones and into masses of aquatic vegetation, occasionally snapping up a crayfish or larvae that they have succeeded in dislodging. They do not tear up their food, but swallow it whole, using the forefeet to assist in forcing it down.

"The stomachs of three specimens, opened during the latter part of June, contained the following:

1. A large female contained nine medium sized crayfish, only slightly digested.
2. A medium sized female contained four crayfish and twenty-two dragon-fly larvae.
3. A large male contained nine dragon-fly larvae and a few plant buds, probably taken by accident when snapping up larvae."

Surface (1908, 123) has recorded the following observations on the food habits: "Unfortunately, only two of the Soft-shelled Turtles available for examination contained food, although a greater number were examined and found to be empty. Of these neither had eaten any vegetable matter, but both contained Crayfish, which are common inhabitants of streams they frequent, and are doubtless among the chief elements of their food. In devouring Crayfish (or Crawfish), any creature is objectionable from the fact that it is one of the most important foods of the carnivorous fishes. Hay asserts that it feeds on such fishes and reptiles as it can secure.'

"One Soft-shelled Turtle was found to contain fragments of beetles so broken as to be beyond recognition, but indicating the possibility of these creatures feeding upon insects which may be found floating on the water or in damp places frequented by such turtles.

"We take this opportunity to record the fact that we have found the Soft-shelled Turtle feeding upon grains of corn obtained in or near the ponds which they inhabit. A specimen examined by us in Ohio some years ago contained both yellow and red field corn, or Indian corn, to the extent of almost as much corn as would be produced upon two average ears of this plant."

Mating must take place during April or May (Newman) and the nesting period extends from about the middle of June to the middle of July. Newman states that "The character of the soil seems to be immaterial so long as it is near the water's edge. Nests were found in clay so hard packed that one could scarcely break it with the fingers. One nest was made in a rock pile, the eggs being dropped into crevices between the rocks, and sand packed around them. Several nests were made among the smaller roots of a tree growing on the sandy beach, the eggs being deposited between and under the roots in a very irregular fashion. The majority of nests, however, were found in the soft beach sand over six feet from the water."

The same writer briefly describes the nest building as follows: "A warm sunshiny day. Place: the 'old road' about ten feet from the water's edge and concealed from view on one side by tall grass. A large female *Aspionectes* has just escaped from the grass and is commencing to make a nest. No time is lost in selecting a spot. She scratches out footholds for the forefeet and begins to excavate with the hindfeet, using right and left alternately with a circular gouging movement. As the hole becomes deeper it is generally necessary for her to give a more nearly perpendicular thrust with the hindfeet.

"In less than forty minutes the nest is completed and she has commenced to lay her eggs, letting the tail down into the narrow hole as far as possible. After depositing several eggs she arranges them with the hindfeet and then rakes in some earth previously wet up with water from the accessory bladders. The earth is gently packed in before any more eggs are laid. The remainder of the eggs are deposited and the hole is filled up with earth and tramped down quite firmly with the knuckles of the hind feet, right and left feet being used alternately. This treading movement continues for some minutes and seems to be quite thorough. Although not in any way disturbed, the tortoise left without attempting to cover up the traces of scratching feet, and anyone who is familiar with the appearance of a tortoise nest would have no difficulty in detecting this one. At 12:25 she turned and started for the water but was captured with a landing net. The nest was examined "and found to be flask-shaped with a narrow neck only an inch and a half in diameter. The depth of the nest was a trifle over six inches and the diameter at the bottom about three inches. The nest

contained eighteen rather large spherical eggs of a delicate pink color and with a very thin brittle shell."

After the breeding season is over they spend their time in the water, and as the cold weather comes on, bury themselves in the mud and sand of the bottom where they remain until the following spring.

The soft shelled turtle is highly valued as food, the flesh being delicate and of excellent flavor. Individuals attain a large size, and are rather readily shot or caught with a hook and line.

Range: The species has been reported from: Michigan (Agassiz, 1857, 404-405); "Southern half of the Lower Peninsula. It is frequently met with as far north as Genesee County, and in the streams of the eastern as well as the western slope of the state" (Miles, 1861, p. 233), Ann Arbor (Smith, 1879, p. 7), Eaton County (Clark, 1902, p. 193); Ann Arbor, Brookfield, Olivet; and Allegan, Kalamazoo, Montcalm and Van Buren Counties (Clark, 1905, p. 110), and Cass County (Thompson, 1911, 107). The writer has seen specimens from: Ann Arbor and Portage Lake, Washtenaw County, White Pigeon, St. Joseph County, Cass County, Kalamazoo County and Allegan County.



Figure 45. Distribution of *Platypeltis spinifera*. Horizontal ruling, specimens examined; vertical ruling, reports only.

CHELYDRA SERPENTINA (Linnaeus).

SNAPPING TURTLE.

(Pl. VI.)

Chelydra serpentina, Sager, 1839, 301. Smith, 1879, 7. Clark, 1902, 193; 1905, 110. Kirsch, 1895, 333. Miles,

1861, 232. Hankinson, 1908, 236. Thompson, 1911, 107. Ruthven, 1911a, 271.

Description: Carapace rigid, covered with horny plates, broadly oval in outline, rather depressed and serrated behind. There are three moderate keels on the carapace, one median and two lateral, very prominent in the young, less so in old individuals, the keels tuberculated, the tubercles with radiating edges. Plastron small, leaving most of the body exposed, bridge narrow. Tail long and tapering. Under surface covered with large scales, the upper surface furnished with a row of large horny tubercles; other smaller tubercles on the upper surface of the tail. Head large and flattened above, and with rather conspicuous bony ridges; snout rather pointed; both jaws terminating in a hook. Large, transverse, sharp-edged scales on the anterior part of the fore leg. Skin wrinkled and covered with prominent warts.

The color of the carapace may be very dark olive, brown or black. Upper parts of head, neck, limbs and tail brown or black, the tips of the warts and various lines on the head frequently yellow or brown. Plastron and under surface generally mostly dull yellow.

Habits and Habitat: This is the largest turtle native to Michigan. True (1893, 153) gives the maximum weight as twenty or thirty pounds. It is extremely pugnacious in disposition, and uses its sharp and powerful jaws upon slight provocation. Large individuals are to be handled carefully, as their powerful, keen-edged jaws are capable of inflicting a severe injury.

Snapping turtles prefer the quiet water habitats, such as lakes, ponds and the pools of sluggish streams. They frequently lie partly embedded in the mud of the bottom, snapping at their prey as it comes within reach; in this habitat they are rendered more inconspicuous by the mat of algae that often grows on the shell. According to Newman (1906, 150), they may also stalk their prey. They are carnivorous, and, according to Garman (1893, 245), "their food consists of all manner of small animals, such as fishes, frogs, reptiles, and young water birds." Hay (1892a, 558) states that "a large specimen that I dissected had in its intestine the feathers and partially digested bones of a full grown robin. The wing and tail feathers filled up the intestine. Its excrement contained the remains of a crayfish."

Numerous other authors mention the food of this turtle but the observations of Surface, who has published the following table, are the most exact.